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READJUSTMENT OF RANK.

FOR a number of years the scheme to readjust the rank of officers of the army has been agitated, and on two recent occasions has come so near succeeding that it behooves every man interested in the question to look into the matter, and at least satisfy himself as to which side has the right.

The question has reached an importance never before attained by it, and has apparently defeated one or more attempts to reorganize the artillery and infantry arms of the service; indeed, one of its supporters, who seemed to have Congressional authority for his utterances on the subject, has said that there will be no reorganization that does not include a readjustment of our rank as officers. Until October, 1890, the practice in our service has always been to promote regimentally up to and include the grade of captain; for two years it is supposed that promotions to major were regimental; but with that possible exception promotions to the different grades of field-officers have been according to seniority in any arm or line.

One of the results of this system has been to make promotion in the different regiments of the line very unequal, some regiments having officers four or five years behind others in the same arm, but of the same or greater length of service. The officers thus passed by their more fortunate comrades, being dissatisfied with this condition of affairs, have for years been endeavoring, by Congressional legislation, to effect a rearrangement or readjustment of rank which would give back to them and to others the relative rank possessed on entry into the service.

The friends of readjustment claim that injustice has been done them; they say that under Section 1204 of the Revised Statutes the lineal system of promotion to all grades should have been followed ever since that section became law; that the regimental system was intended to be suspended by the section named, and that, consequently, they are entitled to the relative rank which lineal promotion would have given them. They say that it is never too late to right a wrong, and that even now it is right and just and feasible to restore to them what they contend should be theirs. It is claimed that the wording of Section 1204 is very plain in its meaning, and that no other reasonable construction can be put upon its language than that after the section became law, only lineal promotion could justly obtain. Those who object to the threatened change are said to be unjust to their brother officers, unfair and even selfish.

The result of readjusting our rank as contemplated by the bills before Congress during the past two or three years, and which came so near becoming law, would be, in the different parts of the line, to so rearrange our relative rank as to give each officer place according to total length of service as a commissioned officer. With officers of the same grade—as captain—no attention would be paid to date of last commission, or of the one before, the only consideration being the date of original entry into the service as a commissioned officer, and to the total number of days of such service.

About one-half of us would be moved up, the other half taking lower places. It is possible, but hardly probable, that some officer in the line would retain the relative place now held by him. The most striking changes would occur in the list of majors and captains; from lieutenant-colonel to captain, officers would be passed in promotion to the next grade by others from the grade below. Some who served as officers in the rebellion would have to stand aside and witness the promotion of the graduates of 1866, unless the law should happen to allow volunteer service equal weight with service in the regular army.

Naturally the men thus legislated out of the places so long held by them, and which they believed to rightly belong to them, would ever after endeavor to regain, by the same means, what was taken from them. But if they have been enjoying all these years that which should have belonged to their friends in the ranks of readjustment, why should they object to the restoration?

The officers who have been benefited by the regimental system of promotion reply that their relative places rightly belong to them; that it would be rank injustice to deprive them of what they have possessed so long in all the security granted by acts of Congress and army regulations. The remainder of this paper will be devoted to the task of showing that they are right.

All of us who entered the military service prior to October, 1890,

did so with the full knowledge that our promotion to the rank of captain would be regimental, and with that understanding and belief we entered into our several contracts with the government.

The great majority who came in since 1865 had considerable choice as to arm and regiment in such arm, and, balancing in our minds the relative weight and importance to be allowed to the different considerations at work within us, we made our selections; some went into the artillery, some chose the cavalry, and others the infantry. Each man believed that his selection was the very best that he could do for himself under the system then existing, and we know of no other.

Each of us knew very well that under the regimental system the date of each man's promotion to the next grade would depend entirely upon choice of regiment and arm of service. With that before us we spent much time in deliberation and inquiry, meaning to get the very best results under the existing system, and in this way did we, in the beginning, really divide the appointments offered us by the government.

Deliberately we made our beds, and we should lie upon them without a murmur.

The friends of readjustment have not allowed this argument its proper weight; it is reasonable to suppose that they do not altogether ignore it.

Then, has the government broken its contract with us? If not, right and justice are forever banished from the demand for readjustment. The cause of the dissatisfied hangs altogether upon the meaning of Section 1204 of the Revised Statutes, forgetting that they have reaped only the fruit of their own acts. They practically claim that the government has broken its contract with them through the interpretation given to that section by the War Department.

Having seen what would be the effect of readjustment of rank; knowing that the majority of the officers of the army deliberately selected regiment and branch of service with the full knowledge that the regimental system of promotion to the grade of captain was then the recognized rule, such selection having for its object the best obtainable results under that system, it would seem that, in order to possess the shadow of a claim to justice, the present, past, and future efforts to readjust our rank should be based upon law as clear as mid-day, prescribing such readjustment in language not to be misunderstood.

Is Section 1204 such a law? After I had heard so often that the language of Section 1204 was very plain in meaning lineal promotion, and that the beneficiaries of the regimental system were enjoying what should belong to other officers, I determined to carefully read that enactment of Congress and see for myself what wrong and injustice had been done to my comrades.

Having read it once, it seemed to me that I must be very stupid

not to grasp a meaning so evident; so I read again, more carefully, for I wished to understand. Then it began to dawn on me that the intention to prescribe lineal promotion was very vaguely expressed, to say the least, and, finally, after the careful weighing of every word in both clauses of the section, the only conclusion I could arrive at was, and is, that the regimental system of promotion was not affected by Section 1204 in any way. What was expressed meant that vacancies in the artillery would be filled by promotions from the artillery *only*, the same principle applying to the infantry, cavalry, and the various staff corps, no reference being made to either system of promotion, leaving that to be settled by the War Department, according to the "established rule."

The War Department has always been the proper authority to interpret for us the acts of Congress affecting the army, and the making of many laws concerning us by a body of civilians has compelled our representatives in Washington to be very careful to grasp the full meaning and intention of every such law, and we may rest assured that Section 1204 received unusual study and consideration.

The Act of June 26, 1812, authorized promotions within the several lines of the army, respectively, "according to established rule." That rule, well known before, was republished in the Army Regulations of 1813, and governed till 1890, being strengthened by the Act of March 30, 1814, and was not disturbed by that of March 3, 1851. The prominent feature in those three laws of Congress is the careful requirement that each officer must remain in his own line, in his rise from grade to grade, the manner of his promotion to the next higher grade being left for settlement by the War Department, "according" or "agreeably to established rule."

Such being the meaning of the acts of Congress, and of the established rule, how could a revised statute be built out of them with lineal promotion to captain as its foundation, a meaning utterly foreign to the truth? That the commissioners appointed by the President to "revise, simplify, arrange, and consolidate" the statutes of Congress had no authority to introduce into any revised statute a meaning utterly at variance with that expressed by the acts of Congress on any given subject, is proved by the following extract from the act of June 27, 1866, directing the first revision:

"The commissioners shall bring together all statutes and parts of statutes which from similarity of subject ought to be brought together, omitting redundant or obsolete enactments, and making such alterations as may be necessary to reconcile the contradictions, supply the omissions, and amend the imperfections of the original text."

The acts of March 30, 1814, and March 3, 1851, say nothing of regimental or lineal promotion, yet they are the acts revised, as shown by the notes on the margin in the different editions of the revised statutes.

The deciding by the commissioners of the question, "lineal or regimental," might perhaps have prevented much controversy, but to decide a question which had not been raised in any law of Congress, while possibly a wise act, would surely have been a very queer one. It would have been the making of a new law, and Congress reserves that power to itself.

That the interpretations here given to the laws and regulations on the subject of promotion are correct can easily be seen by examination of the language used in them.

The first efforts to establish a system of promotion for army officers is thus described by the Senate committee of the Forty-sixth Congress.

On the 27th December, 1776, a resolution was adopted by Congress authorizing the commander-in-chief, General Washington, "to fix upon the system of promotion in the Continental Army, which, in his opinion, and that of the general officers with him, would produce most general satisfaction," and it was suggested that perhaps a promotion of field-officers in a colonial line, and of captains and lieutenants in a regimental line, would be the most eligible method, and it was accordingly adopted. When the army was organized into a legion with four sub-legions, in 1792, promotion was lineal in each to the rank of captain, inclusive, and thence in the arm of service. September 9, 1799, the rules for promotion throughout the army were changed in general order by President Adams, and these new rules remained in force until May 26, 1801, when they were abandoned and the old state of things re-established. It is difficult now to ascertain what these rules were, but it is supposed that they were "that all officers shall rise in the regiments to which they respectively belong to the rank of major inclusively; that afterwards they shall rise in the line of the army at large, with the limitation, however, that the officers of artillery, cavalry, and infantry shall be confined to their respective corps until they shall attain the rank of colonel."

The rules for promotion re-established May 26, 1801, by Mr. Jefferson, were well understood.

These rules, published in an order of the Secretary of War, were as follows:

"Promotions to the rank of captain shall be made regimentally."

Act of June 26, 1812, Section 5,—"And that from and after the passing of this act, the promotions shall be made through the lines of artillerists, light artillery, dragoons, riflemen, and infantry, respectively, according to established rule."

The foregoing shows what that rule was. Notice that while great care is taken to keep promotions strictly within the several lines of the army respectively, the manner of promotion in such lines is left entirely to be settled by the War Department.

The established rule is given in full in the old Army Regulations of 1813, and reads as follows:

"Promotions to the rank of captain will be made regimentally; to that of field appointments by line, *the light artillery, dragoons, artillery, infantry, and riflemen being kept always distinct.*"

Evidently the War Department had been greatly impressed by the desire of Congress to keep promotions within the several lines respectively. The italics, however, are mine.

Act of March 30, 1814, Section 12,—"That from and after the passing of this act, promotions may be made through the whole army in its several lines of light artillery, light dragoons, artillery, infantry, and riflemen respectively; and that the relative rank of officers of the same grade, belonging to regiments or corps already authorized, or which may be engaged to serve for five years, or during the war, be equalized and settled by the War Department, agreeably to established rule, etc."

The law goes on to repeal so much of the Act of June 26, 1812, as came "within the purview and meaning of this act."

This is the last of the old acts of Congress regulating promotions in the army, and it was revised and made the basis of the first clause of Section 1204, its language being used as much as possible in that section. Promotions are still carefully kept distinct and separate in the several lines, and the manner of promotion clearly authorized to be settled by the War Department.

Act of March 3, 1851, appropriations for pay of the army, etc., *provided*, "That all promotions in the staff department, or corps, shall be made as in other corps in the army."

The only requirement regarding promotion, which was settled by the act of March 30, 1814, is evidently that of keeping promotions within the several lines respectively, and this requirement is the only one that could have been intended by the act of March 3, 1851, to apply to the several staff departments. In both acts the established rule is left entirely to the War Department, which again enunciated that rule in 1863.

ARMY REGULATIONS OF 1863.

"All vacancies in established regiments and corps, to the grade of colonel, shall be filled by promotion according to seniority, except in case of disability or other incompetency. Promotion to the rank of captain shall be made regimentally; to major and lieutenant-colonel and colonel, according to the arm, as infantry, artillery, etc., and in the staff departments, and in the engineers and ordnance, according to corps."

SECTION 1204, REVISED STATUTES.

"Promotions in the line shall be made through the whole army, in its several lines of artillery, cavalry, and infantry respectively. Pro-

motions in the staff of the army shall be made in the several departments and corps respectively."

The revised statutes having been re-enacted by Congress, Section 1204 now becomes the law.

In order to be clothed with even the shadow of right, the claim for readjustment of rank should be supported by an undoubted and clearly-expressed demand for lineal promotion in the language of that section.

Not only is there no such requirement expressed in Section 1204, but there is utter silence on the question as to lineal or regimental promotion. That this is so, is evident from an examination of the acts of Congress and army regulations given, and, excepting those who interpret the law for us, we have no other authority on the subject. The commissioners, learned in the law, have used in Section 1204, as far as possible, exactly the language given in the statutes revised. The law built from those statutes must naturally express the same meaning, omitting parts that no longer apply, and the second clause of the section assists the interpretation of the first part, and in both clauses there is a noticeable absence of the words usually employed to express lineal promotion.

But so much had been said and written on the subject that the War Department in 1889, for the last time, told the world that Congress had not interfered with the "established rule."

ARMY REGULATIONS, 1889.

"SECTION 21.—Promotion to established regiments, corps, and departments, to the grade of colonel, will be made according to seniority, except in case of disability."

"SECTION 22.—In the line of the army promotions to the grade of captain will be made regimentally; to major, lieutenant-colonel, and colonel, according to arm of service."

Only another way of expressing the meaning of the previous regulations.

The first act of Congress which deals with the manner of promotion in any line, or in any staff corps, is the following:

ACT OF OCTOBER 1, 1890.

"That hereafter promotions to every grade in the army below the rank of brigadier-general, throughout each arm, corps, or department of the service, shall subject to the examination hereinafter provided for, be made according to seniority in the next lower grade of that arm, corps, or department, etc."

Whatever may be the respective merits of the two systems of promotion, the question was decided and settled by this act of Congress, which is given here only to complete the history. Such a history of the different acts of Congress and army regulations previous to the

revision of the statutes of Congress is necessary to the correct understanding of Section 1204.

We see that promotion to the grade of captain had from 1776 always been regimental; that two acts of Congress had expressly authorized and sanctioned such a system; that the wording of that part of Section 1204 affecting the line was taken from the Act of March 30, 1814, as nearly verbatim as could be under the changed conditions limiting the branches of the line to infantry, cavalry, and artillery; that the acts of Congress upon which Section 1204 was based having given legislative sanction to the regimental system of promotion, no other system could be prescribed in a revision of such statutes, which in the section named used the language and therefore the meaning of the acts themselves.

No act of Congress having ever defined the manner of promotion in any of the lines of the army, it was beyond the authority of commissioners to do so in the revised statutes, except to follow the system sanctioned but not explained by the different acts. To do otherwise would have been to make a new law, the power to do which Congress reserves to itself. The language of Section 1204 shows clearly that the commissioners, "learned in the law," were careful to follow the wording and meaning of the statutes revised; the different acts of Congress having prescribed only that promotions in any line should be confined to such line, the commissioners very correctly limited themselves to repeating such requirement in the revision, leaving the manner of promotion undisturbed.

Suppose that the commissioners had full authority to do away with the established rule in the revision of the statutes, and that they wished to do so; how is it possible to imagine them using in such revision the language revised and yet intending to give the revision a contrary meaning? The men selected to revise acts of Congress are able and learned. Readjustment now would mean simply the taking from one set of men and giving to another and different set that which the first set have possessed for years in all the security which the sanction of law can bestow. And when we remember the manner in which, in the beginning, we divided among ourselves the appointments to the army, those who have been benefited by the established rule having, to a great degree, to yield to the others first choice and take what was left, the struggle for a new arrangement loses whatever of justice a mistaken interpretation of the law might seem to warrant.

The question as to the meaning of Section 1204 arose immediately after the first revision of the statutes, and since its re-enactment by Congress, going into effect December, 1873, secretaries of war, commanding generals, adjutant-generals, and judge-advocate-generals have all been called upon for an expression of opinion. The unanimity with which it has been decided that Section 1204 did not refer to the

manner of promotion in any line, and that promotions had been strictly within the meaning of the revised statutes, taken together with the fact that all of these officials were removed from a personal interest in the question, should satisfy the most scrupulous.

General Sherman has said that "the present rule of promotion has existed since the formation of our government;" the Senate committee of the Forty-sixth Congress, after fully investigating, came to the conclusion that "from that time [meaning June 26, 1812] promotion in the army has gone on not in accordance with rule, but in accordance with law;" and in April 14, 1882, the Attorney-General of the United States, in deciding the question, stated "that the rule laid down in paragraph twenty, Army Regulations, by which 'promotions to the rank of captain shall be made regimentally,' is not inconsistent with the provisions of Section 1204, Revised Statutes, but that it remains in full force."

Every full investigation of the subject by those who make our laws, as well as by those whose duty it is to interpret them, arrives at the same conclusion.

Regarding the question, lineal or regimental promotion, whatever has happened to any officer came with the full sanction of the highest law of the land. That the regimental system worked dissatisfaction to many is true, but during the same time any other system would have failed with just as many, and to as great an extent. We have earned our present relative positions in honest compliance with the law, and to change the present status by the enactment of a law working backward in its opposition to the one now in force, would, under all the circumstances which have aided to make the present, work a legislative wrong beyond comparison with the disappointment felt by some officers over their failure to obtain equal promotion with their comrades. It is time that the efforts to readjust our rank should cease.

C. J. CRANE,
Captain Twenty-fourth Infantry.

FORT BAYARD, NEW MEXICO,
November 12, 1894.

RECOLLECTIONS OF ERICSSON.

ISAAC WALTON said, "Doubtless God might have made a better berry than the strawberry, but doubtless He never did." I am bold enough to say, a greater engineer than Captain Ericsson may have lived, but a list of his deeds has not been recorded.

I write of him as an engineer rather than inventor, because he so wished himself considered. In a letter to me he wrote, "Allow me to remind you that I am an engineer and designer rather than an inventor. Is the capacity for construction, gained during the experience of a lifetime, an invention? Edison in his ignorance discovers or invents,—Ericsson, acquainted with physical laws, constructs." This was not said in any spirit of disparagement of Edison, for whose talents and achievements Ericsson had the highest respect. It was not his custom to speak ill of others, and he was always quick to rebuke those who sought to gain his favor by depreciating the accomplishments of those working upon the same lines as himself. He acknowledged ability wherever shown, and never failed to give credit where due. This was particularly so where his own work was concerned. A perfect execution invariably brought the inquiry for the workman's name, and not infrequently was the mechanic summoned to the captain's presence to receive a personal commendation, and generally some substantial acknowledgment. How galling to such a nature to have his ideas appropriated and his labors discredited!

In a letter to General McClellan, who was directing the work on the "Stevens Battery," the captain wrote, "The allegation that I received aid in designing the 'Monitor' and other work during the war is absolutely false. The entire labor of preparing the original working plans was performed by myself, every line being drawn by my own hand."

His drawings were masterpieces,—not only executed with wonderful dispatch, to which I shall refer later, but with a nicety of finish that I have never seen equaled. Riding from his house in Beach Street one afternoon with a drawing he had just given me, I met in the car Jacob Worden, a well-known engine-builder, himself a skilled draughtsman. Knowing he would be interested in the subject, I showed him the plan. After studying it a few minutes he said, "There is only one

man living who can make a drawing like that; Captain Ericsson drew that plan."

I was at this time associated with Cornelius H. DeLamater, Captain Ericsson's closest friend for fifty years. Mr. DeLamater was my father-in-law, and we carried on the DeLamater Iron Works. At these works were constructed all the machinery designed by Captain Ericsson while I knew him.

My acquaintance with Captain Ericsson began in 1870,—our friendship the following year. From that time up to within a few months of his death it was my privilege to meet him regularly at a certain hour every Monday. He never failed to be ready to receive me. I could not always keep my appointments. It was always necessary when that was the case to send him timely notice. Punctuality was imperative with him, and strict punctuality. I have waited at his door many times, in order to be announced on the stroke of the hour. At such times his reception was most hearty, generally standing at the door of his working-room with his extended hand, and often an embrace. When I had the misfortune to arrive late—and with him one minute was late—I would find him seated in one particular place, and I was very lucky if I escaped with as mild a greeting as, "My young friend is late to-day."

We did not always discuss business at these interviews. Many of our conferences were naturally concerning work in hand; but the most interesting to me were those when he talked of the events of the day, the achievements of others, of himself, his beliefs, his past. He was the best talker I ever met, every expression terse, yet full, saying the most in the fewest words possible. It is hardly proper to characterize it as talk. His subject took full possession of him. His words came in torrents, gathering force as each new idea crowded for expression. It was not safe to interrupt, and rarely did one have the desire. On more than one occasion, starting on some subject, he talked the full hour without giving me the chance to say one word; then, suddenly rising, he would put out his hand saying, "I am sorry you cannot stay any longer." It is needless to say that closed the interview.

Some may have seen the statue erected on the Battery in New York City by the State of New York. This was cast at Gorham's in this city two years ago, and was an excellent model.

Captain Ericsson was not a tall man,—measuring only five feet seven and one-half inches. He was stoutly built. His chest and shoulders showed the athlete. His head was large; every feature of his face was strong, particularly the mouth. His voice was powerful, and he could thunder with it. Without being so, he gave one the impression that he was a large man. His dress was peculiar. During the last twenty years of his life, whenever I saw him, winter or summer, he invariably wore two frock-coats, and always with vest and stock of buff Mar-

seilles. His secretary told me that during the war he found a piece of piqué that pleased him very much, and bought all the tailor had,—some one hundred and forty yards; this was all used for his vests and stocks.

Seated before him, I always felt that he was of a superior order of beings,—of a race from which kings should spring. His strength was prodigious. During one of his visits of inspection to the DeLamater works, he stumbled over a bar of iron: turning to two workmen, he asked them to remove it, but they said it was too heavy. Nettled at this refusal, he stooped over, picked up the bar, and, carrying it across the shop, threw it on a scrap-heap. Amazed at this exhibition, the men procured assistance at noon-time and weighed the bar: it showed on the scales five hundred and ninety-two pounds.

His life in Beach Street was ordered with military precision. His simple diet was chosen with care, and measured with exactness. His baker supplied for his use each day two loaves of bread of given size, which he entirely consumed. He used no intoxicating drink nor tobacco in any form. He was fond of strong tea, and drank it regularly. Every morning he had his calisthenics for two hours; then his bath and rub-down. When he left his drawing-board at night he took a brisk walk before retiring, often walking eight or ten miles, and few who met the rapid walker with his long-striding gait, arms full swinging, ever suspected his identity. He rarely left his house during the daytime.

I remember on the morning of his eightieth birthday he told me he had that morning turned a hand-spring, and added that he felt he was good for a hundred years. Chiding me for not coming to a regular meeting, which fell on Christmas-day, I asked him how he had spent his holiday. His reply was, "I had two chops for breakfast instead of one." As late as 1888 he wrote to a friend, "I very seldom quit my drawing-table before 11 P.M., and not once in the course of a year go to bed before half an hour past midnight. Brain, muscle, and eyes, thank God, all hold good." He was then past eighty-five.

Let us go back to his life and work of earlier years. Space will not permit of even the chronological mention of his achievements,—if I wrote all I could of the first twenty-five years of his life, it would exclude the possibility of any mention of Ericsson in America.

This has been the century of mechanical triumph, and Captain Ericsson began his life on the threshold of it. He was born July 31, 1803, in the province of Vermland, Sweden. To-day this same province is governed by his nephew, Baron Ericsson, son of the captain's brother, Nils, who attained great distinction and honor for his engineering achievements. The Ericssons had for over a hundred years lived in this same district. The grandfather of John was a large

mine owner. These mines were left to Olof, the father of John; but a better inheritance than ancestral wealth was the education that Olof received. To it was due the early influences that shaped the career of Captain Ericsson. Olof Ericsson was a clever mathematician, and possessed an excellent mechanical judgment. He made no name for himself, but the world owes him honor for what he did for his children.

In John's earliest boyhood, his delight was to be in the mines studying the machinery and making drawings. Reverses came early to his father, and John knew what it was to be poor. To make his drawings John had constructed his own set of instruments, and in afterlife was very proud of them. At the age of nine he constructed a saw-mill, using a watch-spring for a saw, transformed by the aid of a file borrowed from a neighboring blacksmith, and from a broken tin spoon he cast his crank. He built a water-wheel, and attached his saw-mill to it, and had the delight of seeing the machinery in actual operation, sawing sticks. The next summer he designed a pump for drawing water from the mines. The motive power was derived from a windmill. He had never seen a windmill, but he built it from descriptions given by his father. It failed to work, because it had not been adjusted to the changes of the wind. His father, describing a visit to a neighboring mine, spoke of a ball-and-socket joint. The idea was seized at once by John, and he joined the connecting rod for his crank to the pump-lever with a ball-and-socket joint. From early infancy John Ericsson was connected with great engineering works, the Göta Canal being a marvel of canal-building even for the present day.

At the age of eleven, John was appointed a cadet in the Mechanical Corps of the Swedish navy; at thirteen he was made assistant leveler on the Göta Canal; at fourteen he received the appointment as leveler on the east line of the canal, his salary being thirty crowns a month, with quarters and traveling expenses. He had gained such skill that when he was fourteen years old six hundred Swedish troops labored upon the canal under his directions, though he was still too small to reach the eye of his leveling instrument without the aid of a stool.

At seventeen the military spirit took possession of him, and after much opposition from his engineering advisors, he was assigned to the Twenty-third Regiment Rifle Corps, with the rank of ensign. Into this new life he threw all his energy, studying it scientifically, and mastering every detail. He made a special study of the science of artillery, and in his after-life he reaped the full benefit of this labor. In 1810, on the death of Charles XIII., Bernadotte, a maréchal of Napoleon, had assumed authority over Sweden as elected crown prince. His son, the young Duke of Upland, became acquainted with Ericsson, and showed his father a military map made by the ensign, then in his eighteenth year. It so pleased the crown prince that he secured for

Ericsson a commission as lieutenant, and he was summoned to the royal palace to draw maps, and to illustrate the campaign of the maréchal of the empire. Soon after he joined the service orders were given to survey the District of Jemtland, where he was stationed. The work was secured by competition, and Ericsson easily won a prize. The pay was in proportion to the work accomplished. Ericsson was so rapid of execution that he performed more than double duty, and he was carried on the pay-rolls as two persons, in order to avoid criticism and charges of favoritism. At the age of twenty-two he constructed his flame-engine.

He was restive under the restraint of his new life, and his inventive spirit cooled his military ardor. Showing the drawings of his flame-engine to King Charles, he was advised to go to England, as there he could find a more fitting field for his ambition. He had no money, but, being strongly urged by his brother officers, he accepted a loan of a thousand crowns from one of them, obtained a leave of absence, and in May, 1826, he landed in England, bringing with him his flame-engine. He was doomed to disappointment with this venture, for he was obliged to burn coal instead of the resinous wood of his native land, and the intense heat generated by the combustion of the coal destroyed the working parts of his engine; but if his immediate purpose was not realized, his removal to the new field was timely.

A new era was opening in the engineering world. All things were to be made new, and there was need of men who could discard the teachings of precedent without substituting the conceit of ignorance. He was fortunate in meeting John Braithwaite, and soon became associated with him as partner in his machine manufacturing establishment. Now followed invention after invention in rapid succession. An engine using steam, combined with the gases arising from the combustion of coal; next a start towards his future caloric engine,—an engine with two cylinders, in one of which was a loosely-fitting piston, and directly under this he placed his fire, the loosely-fitting piston actuating his working cylinders. In this engine he forced the air through the fire, combining it with the gases of combustion. Then he constructed a pumping engine, consisting of a series of cisterns rising one above the other; by exhausting the air from these cisterns in succession the water was raised to the desired height.

In 1828 he constructed an air-compressor, which was placed in successful operation in the tin-mines near Truro, in Cornwall. It had an air-cylinder of twenty inches diameter and five feet stroke. This operated a machine for raising water from a mine shaft at a considerable distance from the shore where the compressor was located. Upon this invention Captain Ericsson founded his claim for priority in the use of compressed air for transmitting power.

When in the early seventies power rock-drills came into use, the

Ingersolls and the Rands, the pioneers in this field, had their machines built at the DeLamater Iron Works. They were constructed to be driven by steam. In open work this was attended by little inconvenience, but in confined work (in mines and tunnels) the difficulties were great, and some substitute for steam was at once sought. I remember the conference with Captain Ericsson on this subject. It took place one forenoon, and the next morning, when I reached my office, I found on my desk working drawings for an air-compressor. We built these compressors in large numbers.

In 1828 he patented artificial draught, a year before Stephenson made his reputation by the application of the same principle to his locomotive, "Rocket." Stephenson applied it to Booth's tubular boiler, having an external fire-box attached to the boiler. This tubular boiler was itself anticipated by Ericsson in 1827, when he built a boiler fitted with copper tubes, which was also provided with an internal furnace. This boiler was placed in the steamer "Victory," which Braithwaite and Ericsson built for Captain Ross, who was endeavoring to find the Northwest passage. The steamer had also Captain Ericsson's patented surface-condenser. Captain Ericsson in 1868, answering John Bourne, who applied to him for information, wrote, "I claim to be practically the inventor of surface-condensation, applied to steam navigation."

John Scott Russell says, "The condenser is the most wonderful part of the marine engine; it is here that the whole process carried on in the boiler, in so great bulk and at so much expense, is instantly reversed, and all its laborious effects are at once annihilated. Without a condenser of some form the development of the steam-engine would have been impossible." The machinery of the "Victory" was placed below the water-line to protect it from shot, Ericsson supposing he was constructing a vessel of war for experimental purposes. This steamer marked an era in the development of the war-vessel, and the ideas introduced into her for the first time are now common in the machinery of every modern war-ship.

The year 1828 was noted by another revolutionary invention by Ericsson,—the steam fire-engine. He built several, but a generation passed before his invention was used, and then his fire-engine came into service almost without change. The Mechanics' Institute, of New York, voted to Captain Ericsson a gold medal for his steam fire-engine, —the only gold medal ever presented by that institute to an inventor. Captain Ericsson stated in the London *Times*, December, 1875, "Having originated, elaborated, and perfected a new system, I claim to be the father of steam fire-engines."

Now comes the era of locomotive engineering. I cannot enter into discussion of the prejudices existing against the use of railroads for passenger service. It was sufficient to prevent any trial for years.

The Liverpool and Manchester Road finally obtained a charter. The officials published an advertisement offering a prize of five hundred pounds for the best locomotive, conforming to certain stipulations. Five months were allowed for completing the engine. Of the twenty-two weeks, fifteen had passed before Captain Ericsson learned of the competition. He had seven weeks only in which to make his plans and build his machinery. He had never built a locomotive. John Stephenson was engineer of the Liverpool and Manchester Road, and had been five years at the head of an establishment manufacturing such locomotives as were in use in the collieries; and he had the further advantage of controlling the road that ordered the trials, and the sympathy and support of its officials. His locomotive, "Rocket," was virtually completed before Ericsson's "Novelty" was begun. Stephenson tested the "Rocket" in actual practice and remedied its defects, that would have been fatal if left till the day of trial. Ericsson could make no test before trial, and on that day he had to adjust the wheels of the "Novelty" to fit the track. Stephenson had been obliged to conceal the speed he hoped to attain, and ten miles had been spoken of as the limit of possible speed.

For the trials, five engines entered; three were of little moment. The contest was between the "Rocket" and the "Novelty." Stephenson depended on chimney draught. Ericsson provided his engine with artificial means for supporting the combustion in the boiler furnace. A blowing machine was applied, moved directly by the engine, so that the supply of air was greatest when the engine worked at maximum speed. The result was the "Novelty" shot by the "Rocket" like a projectile. The "Novelty" did a mile in fifty-six seconds. The second day the "Novelty" blew out several tubes, and Ericsson withdrew her from the contest.

The London *Times* said, October 16, 1829, "The trials which have taken place have satisfactorily proved the superiority of the principle on which the 'Novelty' is constructed." Speaking of the "Novelty," John Bourne says, "To most men the production of such an engine would have constituted an adequate claim to celebrity. In the case of Ericsson, it was only a single star of the brilliant galaxy with which his shield is spangled." The following year Ericsson built two locomotives,—the "King William" and the "Queen Adelaide." To these was applied for the first time the link motion for reversing steam-engines.

When Ericsson left Sweden he had obtained a leave of absence. He did not return before the expiration of time, and he was technically a deserter. Through the intercession of his friend, the crown prince, he was honorably restored to the service by the issue to him of a commission of captain in the Swedish army. He was at this time twenty-four years of age. This was the proudest title he bore, and he con-

sidered it a greater honor than any of the decorations and orders conferred upon him in after-life. To his friends, and to the world, till his last day, he desired to be known as "Captain Ericsson," although he resigned his commission the day it was received.

In 1830 he patented an apparatus for making salt from brine; in 1831, a rotary engine: two were built on a large scale, one being placed in a steamship. One-half of this patent he assigned to William Laird, of Birkenhead, the founder of the great ship-building firm. Mr. Laird bore the entire expense of these engines. The friendship established with William Laird lasted through three generations.

The next year he applied a centrifugal fan-blower, driven by a separate small engine, to the steamer "Corsair." The independent blower system is now universally adopted, but not one in ten thousand who use it knows to whom he is indebted. From the time of his flame-engine Captain Ericsson was ever seeking some means to develop mechanical power with a less consumption of fuel, and was experimenting with his "regenerative system," using hot air.

In 1833 he took out his first patent for caloric engines. The use of high temperature in the air-engine suggested another step with steam. He followed with his "superheating condenser steam-engine." The deep-sea sounding-machine, known as "Ericsson's sea lead," was his next important invention. When Sir William Thompson, more than twenty years later, patented a sounding-machine, Ericsson ordered one from England. He found on examination that it was almost his identical instrument.

In 1836 he patented an automatic file-cutting machine. I have named these important inventions during his first ten years in England to show how broad a field his investigations covered. In the list of one hundred of his most important inventions, prepared by himself in 1863, he mentions thirty as belonging to those ten years.

It is hard to-day to realize the advance in the world's material progress that has been made by this single brain. You cannot enter any factory in this city where you will not find evidences of his inventive genius; but so common to us that we have never asked whose was the master-mind to whom the credit is due. The next greatest gift to this century—the invention that revolutionized commerce, that made possible the utilization of that other great invention, the cable—was the screw-propeller. Here is his own statement published in 1875 in the London *Engineer*,—

"1835.—Designed a rotary propeller to be actuated by steam-power. The propeller subsequently applied to the steamship 'Princeton' was identical with my design of 1835.

"1836.—Constructed a small propeller-boat, operated by steam-power, in a large circular cistern for the satisfaction of certain parties intending to take an interest in my invention.

"1837.—Designed an engine for imparting motion directly to the screw-propeller shaft, consisting of two steam-cylinders placed diagonally at right angles to each other, the connecting rods of which were coupled to a common crank pin. This engine was applied in the year 1838, to the iron-screw steamer 'Robert F. Stockton,' which crossed the Atlantic under canvas 1839, and was afterwards employed as a tug-boat on the river Delaware for upward of a quarter of a century."

This was the first direct-acting screw-propeller engine ever built. Ericsson's claim to the screw-propeller has not been undisputed; but it was awarded to him by the Royal Society at Moscow, to whom the question of priority of invention had been referred. While there were claimants for the idea, it is undisputed that Captain Ericsson was the first to put the propeller into actual practice. Soon after his patent was granted, he built a steam launch forty-five feet long, using two propellers. This launch was run on the Thames, and made a speed of over seven and a half miles an hour, towing a packet-ship, and excited much wonder among the boatmen of the river. The lords of the British Admiralty were invited to a tow by Captain Ericsson, and with them came many noted engineers. The Admiralty barge was towed easily at a speed of ten miles an hour, but the new invention found no favor with the distinguished guests. The surveyor of the navy, Sir William Symonds, placed himself on record, saying, "Even if the propeller had the power of propelling a vessel, it would be found altogether useless in practice, because, the power being applied to the stern, it would be absolutely impossible to make the vessel steer," and this voiced the opinions of the high lords of the Admiralty,—the invention was condemned! How fortunate for America!

Ericsson had known for a number of years Francis B. Ogden, of New Jersey, consul for the United States at Liverpool. In him he found an attentive listener to his engineering ideas, and a warm sympathizer in his efforts to develop them. Just at this time Ogden's friend, Richard F. Stockton, also from New Jersey, was in England, and was made acquainted with Ericsson. Stockton was building the Delaware and Raritan Canal, and visited England in connection with that work. He was in the navy, and a man of large fortune and family influence. He was induced to accompany Ericsson on one of his excursions on the Thames, and was quick to appreciate the invention received with such cool indifference by the officials of the British navy. A single trip was enough for Stockton. He comprehended instantly what a revolution could be made in naval warfare. He ordered at once two iron boats for the United States, to be fitted with Ericsson's steam machinery and propeller. One of these was the steamer bearing his name, which I have alluded to as the first direct-acting screw propeller ever built.

On Stockton's return to America, he secured promotion in the navy, and was sent abroad with dispatches to the American minister to the

Court of St. James. Again was he thrown with Ericsson. By act of March 3, 1839, Congress had authorized the construction of three ships of war. Stockton assured Ericsson that he would have the building of one of these ships, and induced him to prepare the complete plans for a steam frigate before leaving England.

Ericsson started for New York November 1, 1839, in the side-wheel steamer "Great Western," and arrived on the twenty-third of the same month. He had with him a working model of his engine designed for the steam frigate, and this he set up at once at the Phœnix Foundry, in West Street, New York, and put in operation. It was here that he formed the acquaintance of Mr. DeLamater; a friendship that continued without interruption until Mr. DeLamater's death, one month before the captain's. In Mr. DeLamater, Captain Ericsson found a friend who not only appreciated his great abilities, but one most willing to give him unlimited financial aid.

When Mr. DeLamater made me his partner, I found that the following arrangement between them had been in effect for many years: Whatever experiments Captain Ericsson wished to make at the Iron Works, either in building or testing new machinery, no order was questioned, and no bill was ever rendered Captain Ericsson. If patents were the outcome, they were issued jointly to Captain Ericsson and Mr. DeLamater. The new firm continued the same arrangement; but in balancing off the old books we charged off items aggregating two hundred and sixty thousand dollars that represented a part of those expenditures. Yet the arrangement was one that neither party ever had cause to regret.

Mr. DeLamater was the most intimate friend the captain had. They were in almost daily communication, and for about twenty years Mr. DeLamater dined at the captain's every Monday. I have seen hundreds of letters to "Dear Harry," on every conceivable subject. His letters were models of composition, and always prepared with greatest care; studied when once written to eliminate every word not necessary. Even his great friend "Harry" could not induce him to change his daily routine of life. He was averse to leaving his home. When urged by Mr. DeLamater to visit Niagara Falls, his only reply was, "Is anything the matter with them?" He had under consideration for years the transmission of power by compressed air, which the Falls could develop.

Stockton could not immediately carry out his wishes regarding the steam frigate; but Ericsson was not idle. With the Phœnix Foundry an arrangement was soon made. He at once built a propeller, the "Vandalia," which ran between Oswego and Chicago, followed by the "Clarion," which plied between New York and Havana, and was the first ocean steamer fitted with the Ericsson propeller. Others followed fast, and before the close of 1846 fifty propellers had been constructed, and were plying our rivers, in the coast service, and on the lakes.

In 1842, Stockton sent for Ericsson, and the "Princeton" was started. Her history is the record of the greatest single naval advance in all time. The story of Ericsson's treatment by Stockton and later by the government, in connection with this vessel, seems incredible. The vessel, so far as every construction of Ericsson was concerned, was an absolute success. Her trials were saddened by one of the most terrible disasters in the history of our navy. Ericsson had constructed in England, and brought with him to this country, a 12-inch gun. The butt was reinforced with heavy wrought-iron bands. This gun had been subjected to the severest tests, and to-day it is in the Brooklyn Navy-Yard, a monument to the artillery science of Captain Ericsson. Stockton planned a gun somewhat similar. The two guns were called "Peace-maker" and "Oregon," and were placed on the "Princeton." Her trials on the Potomac were scenes of great rejoicing. The President, his Cabinet, both houses of Congress, and many distinguished guests were crowded on board. The guns were repeatedly fired. Just at dusk a call was made for one more discharge, but the admiral commanding declined. Appeal was made to the President. His assent was considered an order, and the fatal discharge of the "Peace-maker" was made. The gun burst, killing two members of the Cabinet (the Secretary of State and the Secretary of the Navy), a senator, and three others, besides wounding a large number. Stockton sought to lay the blame on Ericsson, but Ericsson's letters to Stockton protesting against the construction of the gun, and pointing out its defects, were a complete answer to this charge.

Ericsson devoted nearly two years of absolute time to the building of the "Princeton," and furnished every plan. For these services he rendered a bill to the government for fifteen thousand dollars, which covered also the use of his inventions. Stockton for years opposed its payment. He received on account during construction eleven hundred and fifty dollars, and his executors are now seeking to collect the balance from a grateful nation! The House Committee on Naval Affairs in 1847 made a favorable report, but it failed to secure the necessary votes. In 1856 the claim was referred to the Court of Claims, which gave a unanimous opinion confirming the amount claimed. Senator Anthony, of Rhode Island, in 1866 introduced a bill in the Senate to pay this amount certified by the Court of Claims. This also failed to pass. Twice since Ericsson's death a bill has been introduced of like effect. It has passed the Senate both times promptly, and without opposition, but it could not be reached in the House. Fortunately claims against the government are exempt from outlawry, and his estate may yet realize the principal of the claim. In both the recent bills there was no attempt to recover interest. We were told such an attempt would jeopardize the collection of the principal. In later years we sometimes spoke of the "Princeton" claim. Whenever I sug-

gested the possibility of securing its payment, I was met with peremptory orders to do nothing. I have felt it my duty as executor to endeavor to collect this claim, but so far I have met with little success.

Captain Ericsson felt outraged at this treatment on the part of the government. There were times when he was hard pressed for money. At the close of the year 1849 his balance at the Manhattan Bank stood $132.32, all the ready money he had in the world. Against this balance in his cheque-book he wrote in Swedish, "A beautiful balance, indeed, to start the New Year with. One gives much for little, as he grows older and more used up." His only book-keeping was done on the margin of his cheque-book, and from these records have we found numberless proofs of his great liberality of heart. Money with him served only two purposes. Its value was not considered when a new idea was to take tangible shape; it was useful to relieve the needs of others. Without these notes in his cheque-book much of his life would have been a mystery; for his diaries, containing entries extending over sixty years, were remorselessly destroyed by his own orders. This act of destruction was prompted by his indignation at Froude's indiscretion in his memorable biography of Carlyle.

In 1854, Ericsson sent to Napoleon III. a plan of a monitor, differing only from what is known as the original "Monitor," in that the turret was a rounded dome. These plans were not adopted, but the emperor was greatly interested, acknowledging them personally, and sending Ericsson a gold medal testifying his appreciation.

The story of the "Monitor" is one too long to be told in full. I can only give it in briefest outline. In 1862, when the days of our Civil War were darkest, the Southern Confederacy was fitting out the "Merrimac;" with her they hoped to capture every port on the seaboard, destroy our commerce, and compel the surrender of Washington. Ericsson, the best-equipped American of the day, was entirely ignored. He had become a citizen in 1848. His friend DeLamater was familiar with the plans sent to Napoleon. These plans had been the result of thirty years' study, and were conceived in his boyhood. "You assume correctly," he wrote to his friend Fox, in 1875, that the plan of the 'Monitor' was based on the observations of the behavior of timber in our great Swedish lakes. I found that while the raftsman in his elevated cabin experienced very little motion, the seas making over his nearly submerged craft, those seas at the same time worked the sailing vessels on their beam ends." He saw then the impregnable war-ship, and only waited the call. Great opportunities are needed for great developments, and the world's best advances have been made through apparent defeats.

The following letter was written by Captain Ericsson to President Lincoln before the "Monitor" plans were submitted, but only a few days before. Remember that Captain Ericsson was an intense man,—

a high-pressure steam-engine himself. It was not that he was not well known to the navy officials at Washington, but that he was too well known. His knowledge was too great, and he was feared. He believed in himself, and history will write that he was correct in his belief.

On August 3, 1861, President Lincoln approved an act appointing a board to determine upon building iron-clad steam-vessels. An advertisement inviting proposals was published, the board was named August 8, and twenty-one days later this letter was sent to Washington:

NEW YORK, August 29, 1861.

SIR,—The writer, having introduced the present system of naval propulsion and constructed the first screw ship of war, now offers to construct a vessel for the destruction of the rebel fleet at Norfolk, and for scouring the Southern rivers and inlets of all craft protected by rebel batteries. Having thus briefly noticed the object of my addressing you, it will be proper for me most respectfully to state that in making this offer, I seek no advantage or emolument of any kind. Fortunately I have upward of one thousand of my caloric engines in successful operation, with affluence in prospect. Attachment to the Union alone impels me to offer my services at this fearful crisis—my life if need be—in the great cause which Providence has called you to defend. Please look carefully at the enclosed plans, and you will find that the means I propose to employ are very simple,—so simple, indeed, that within ten weeks after commencing the structure, I would engage to be ready to take up position under the rebel guns at Norfolk, and so efficient too, I trust, that within a few hours the stolen ships would be sunk and the harbor purged of traitors. Apart from the fact that the proposed vessel is very simple in construction, due weight, I respectfully submit, should be given to the circumstance that its projector possesses practical and constructive skill shared by no engineer now living. I have planned upward of one hundred marine engines, and I furnish daily working plans, made with my own hands, of mechanical and naval structures of various kinds, and I have done so for thirty years. Besides this, I have received a military education and feel at home in the science of artillery. You will not, sir, attribute these statements to any other cause than my anxiety to prove that you may safely intrust me with the work I propose. If you cannot do so then the country must lose the benefit of my proffered services. If, on the other hand, you decide to act, please telegraph, and I will at once wait upon you in Washington. I respectfully submit that in the former case you return the plans, honored with your signature, to testify that I have discharged the duty of laying this important matter before you.

I cannot conclude without respectfully calling your attention to the now well-established fact that steel-clad vessels cannot be arrested in their course by land batteries, and that hence our great city is quite at the mercy of such intruders, and may at any moment be laid in ruins, unless we possess means which, in defiance of Armstrong guns, can crush the sides of such dangerous visitors. I am, sir, with profound respect,

Your obedient servant,

J. ERICSSON.

TO HIS EXCELLENCY, ABRAHAM LINCOLN,
President of the United States.

One of the first sets of plans recommended for adoption by the committee was presented by C. S. Bushnell, and he was awarded a contract to build the vessel known as the "Galena." He consulted

Mr. DeLamater, many of the naval men having doubted her ability to carry the stipulated amount of iron. Mr. DeLamater advised him to go to Captain Ericsson, whose opinion would settle the matter definitely and with accuracy. He called on Ericsson, laid the matter before him, and was requested to call the next day for his verdict. It was entirely favorable. Captain Ericsson then produced his model and plan of a monitor sent to Napoleon. He found a most willing champion in Bushnell, and gave him both plan and model to present at Washington.

Bushnell, knowing Secretary Welles was at Hartford, proceeded there by first train. The secretary urged all possible dispatch to have the plans submitted before the board, and the next day Bushnell was in Washington. He was joined by John A. Griswold and John F. Winslow, both of Troy, and friends of Secretary Seward. The secretary gave them a strong letter to President Lincoln, who went with them to the Navy Department the next morning. Surprised at the novelty of the plan, some advised trying it,—some ridiculed it. It was at this conference that President Lincoln remarked, "All I have to say is what the girl said when she stuck her foot into the stocking,—'It strikes me there's something in it.'" The next day the board condemned the plan. Bushnell labored with them, and won over Admirals Smith and Paulding, who promised to report favorably if Captain Davis would join them. Captain Davis told Bushnell to "take the little thing home and worship it, as it would not be idolatry, because it was in the image of nothing in the heaven above, or on the earth beneath, or in the waters under the earth."

Bushnell felt the only way to succeed was to have Captain Ericsson present in Washington. He came to New York, saw Mr. DeLamater, and together they went to Beach Street. The exact facts were not given to Captain Ericsson, but he was told some explanations were needed that he alone could make. He went to Washington that night. He was told as soon as he appeared before the board that his plans had been rejected. His indignation impelled him to withdraw at once, but he wisely asked why the plan was rejected. He was told the vessel lacked stability. He explained with elaborate demonstration, and so convincingly that Commodore Paulding said frankly and generously, "Sir, I have learned more about the stability of a vessel from what you have said than I ever knew before." He was told the next day by Secretary Welles that a contract would be awarded, and asked to proceed at once with the work. The contract was signed October 25, 1861. The keel of the "Monitor" was laid on the same day. Steam was applied to the engines at DeLamater Iron Works December 30. She was launched January 30, and practically completed February 15, 1862. She made her first trial trip February 19. Ericsson's work during that three months was herculean. Not only the necessary

labors, but the worries from continued doubts sent from Washington, required almost superhuman power.

The "Monitor" left New York harbor March 6, 1862, commanded by Commodore Worden. She arrived at Hampton Roads on the morning of the 9th, and before the sun set that day the famous battle of the "Monitor" and the "Merrimac" was done. What was due to the man whose brain had conceived, and whose will had directed this mighty work that had delivered a nation? The "Monitor" conquered the "Merrimac" before payment had been made, before she had been accepted by the government. Captain Ericsson was permitted to receive his final voucher on March 16, one week after he demonstrated that the doubts at Washington were without foundation.

The war-vessel was changed in one day. The monitor type became the war-vessel of the world. I cannot speak of the many monitors put in hand immediately (within one week Captain Ericsson received and accepted a proposition to build six); I will only refer to one,—the "Dictator." She was the largest that was completed, but was not put in hand until more than a year had passed. In contracting for the "Dictator" the Department conferred upon Ericsson the extraordinary privilege of constructing the ship and her machinery after his own plans. As an evidence of Ericsson's mastery of his work one fact will serve. It is embodied in this statement regarding the "Puritan:" "I have to report that the draught of the ship at the mid-ship section, through centre of forward turret, proved to be eleven feet ten and three-quarters inches, while the launching plan called for eleven feet eleven inches,—difference, one-fourth inch less draught than calculated." The "Dictator" was not completed until December, 1864. She was sent at once to Norfolk, but the war was too far advanced. She was never subjected to the test of battle.

Ten years later we had the "Cuban scare," and the "Dictator" was hurried into active service. The DeLamater works had built both hull and machinery originally, and to them was intrusted her overhaul. She left for the rendezvous in charge of her consort, who lost her off Savannah during a bad storm. The consort put into that port, and it was telegraphed from there that the "Dictator" was lost and all on board. I was summoned to the navy-yard, and requested to convey the intelligence to Captain Ericsson. I reached his home late in the afternoon. He was overwhelmed at the news, but, seeking a cause, he finally concluded that her steering-gear had become disarranged. The next morning, when I reached my office, his secretary was awaiting me with this word: "The captain had been thinking all night, and had concluded that her steering-gear could not get disarranged. The 'Dictator' would report at Key West within twenty-four hours." She arrived at Key West a few hours late.

In 1869 the Spanish government wished to protect Cuba from

filibusters and insurgents. Captain Raphael de Aragon came to Messrs. DeLamater & Co., commissioned to spend a considerable sum, but without any plan. Naturally Ericsson was consulted. He had just been studying the defense of Sweden, and suggested a scheme at once,—to build thirty gun-boats, each armed with a 100-pound gun mounted on her bow. He named two conditions only,—to make his plans without submitting, and that DeLamater should execute the contract. These thirty boats were completed in thirty weeks, and some years later the designer and builder each received from the Spanish government the Commander's Cross of the Order of Isabel la Catolica in recognition of their services.

Ericsson now was at work on harbor defense, and developed, after years of trial, the "Destroyer," which carries a submarine gun and discharges a projectile thirty feet long loaded with three hundred and fifty pounds of explosive. For General Grant a test was made under my supervision, and she performed what her designer claimed for her. She hit a target ten feet square ten feet below the surface of the water, and traversed the distance—three hundred feet—in less than three seconds time.

I am aware of what injustice I am doing Captain Ericsson's work. I cannot even write of his conclusive researches regarding solar heat; of the solar engine he built and ran in Beach Street, developing ten horse-power from the direct rays of the sun; of the caloric ship "Ericsson;" of his numberless achievements. The history of his honors and decorations, almost universally conferred, would, alone considered, make an interesting article. He was recognized by every government of Europe, and by most of the leading societies of the world. He received in 1862, for his "Caloric Engine of 1858," the gold and silver Rumford medals. This prize was founded in 1796 by Count Rumford, a native of Concord, New Hampshire, and was in the gift of the American Academy of Arts and Sciences. They awarded it in 1839 to Robert Hare, and, after forty-three years before its first bestowal, twenty-three more passed before another was found worthy of the award.

On March 9, 1889, on the anniversary of the battle of the "Monitor" and the "Merrimac," came to this man rest. He worked until within a few days of the end. The death of his intimate friend, DeLamater, weighed heavily on him. On March 7 his faithful secretary came to me bringing the sad intelligence of his condition. He said for the first time in his life he was disobeying the captain's orders. The captain had refused to call a doctor, or to have any care except such as was furnished by his assistants. For three days he had lain on a table in his working-room, his favorite resting-place for years. Doctors and nurses were sent at once, but little could be done, and on that memorable day he passed away, saying, "This is rest."

On August 23, 1890, the remains of Captain Ericsson were placed on board the "Baltimore" and sent to Sweden. His native government asked it. His adopted government granted it with every honor possible, sending him home on her finest war-ship. That day's pageant has never been equaled in New York but on one occasion. On the deck of the "Baltimore" on that day I said, committing the remains to the commander of that vessel,—

"Captain Schley, in the nation's tribute to our illustrious dead the simple duty falls to us to yield to the claims of his mother country that she may again receive her son. We send him back crowned with honor, proud of the life of fifty years he devoted to this nation, and with gratitude for the gifts he gave to us.

"Was he a dreamer? Yes. He dreamed of the practical application of screw propulsion, and the commerce of the world was revolutionized. He dreamed of making naval warfare more terrible, and the 'Monitor' was built. After one trial, at the most critical period of this nation's history, where were the navies of the world? The London *Times* said, 'England has no navy.' Again he dreamed, and the 'Destroyer' with its submarine gun was born. He dreamed of hot air, and behold ten thousand caloric engines. He dreamed of the sun's rays in sandy deserts where water was hard to get, and the solar engine came. And so he dreamed and worked for seventy years.

"He bore the strain of unremitting toil, and at the end his last words were, 'This is rest.' Well earned, Benefactor of the World!

"To you, Captain Schley, we commit these remains. An honorable duty is yours. Deliver them to his native country. We keep his memory here."

GEORGE H. ROBINSON.

THE ORGANIZATION AND ADMINISTRATION OF THE LINES OF COMMUNICATION IN WAR.[1]

THOSE who are familiar with the former works of this author will be very glad to learn that Colonel Furse has made another contribution to assist in the advancement of the profession, and they will, moreover, feel assured that the subject is well and exhaustively treated by him.

It is impossible to exaggerate the importance of the subject treated in this book, or to adequately express the necessity of a thorough knowledge of the same by the officers of our army. It is needless to say that the study of this subject has been almost entirely neglected in our army, as the nature of the service which has been rendered by it during the last quarter of a century has been such that, practically, there was no necessity for lines of communication such as are treated of in this book. But that does not relieve us of the duty of thoroughly familiarizing ourselves with everything connected with the same, and as we have no practical experience in this matter we should have recourse to such works on the subject as the experience of officers in other armies enables them to produce.

Colonel Furse says in his preface,—

"Next to fighting the enemy, nothing is of greater consequence in war than to maintain the army in the field in a thorough state of completeness. This, nevertheless, is encompassed by many difficulties, some of which are due to the very little resemblance which the conditions of an army in peace can be made to bear to the realities of active service.

"The proper maintenance of an army in the field is, moreover, inseparable from an endless number of administrative details, which, in the study of the more attractive parts of the art of war, do not meet with adequate attention. The prosperous results of all military operations are based on prevision; this should be as far-reaching as possible, and to be so we must not neglect to take into account what might appear to be very trifling matters."

Napoleon has defined the line of communications as follows:

[1] By Colonel George Armand Furse, C.B. William Clowes & Sons, Limited, London, 1894.

"I intend by the line of communications, the one on which are situated the hospitals, the reliefs for the sick, munitions of war, the supplies; where an army can reorganize itself, recover, and, after a couple of day's rest, regain its *morale* lost by an unforeseen accident."

Every army has a number of administrative departments whose duty it is to provide for the wants of the troops, and whose officers are trained in everything which concerns the procuration, custody, and distribution of those stores which are necessary for the men and animals. These departments in time of peace usually act in a separate and distinct manner, but in war they must be gathered together and placed under the direction of one responsible officer. This grouping together of all the officers intrusted with the maintenance of the army in the field constitutes the *service* of the line of communications.

The importance of a good system of communications has increased as the size of the armies placed in the field have been augmented numerically, and it is impossible to supply the wants of these large armies without a perfect organization of the administrative departments.

Colonel Furse says,—

"One of the most important duties of the staff in peace is to ascertain the requirements of an army in the field in the most minute details, and to foresee all that might occur in war; in other words, to reduce everything to calculation, and to leave nothing to chance. The Germans have set us a good example on this point. They hold that unforeseen occurrences must be reduced to a very few before a war actually breaks out, and that the exceptions, which are never slow in presenting themselves, should have been previously taken into account and regulated as far as possible. Clear and defined regulations are not enough; the officers must make themselves well acquinted with them, and should often ponder on the duties which they may some day be called upon to perform."

It is almost impossible for any number of officers, individually, to collect any information which will be of assistance to the staff in time of war. This work must be done by a special body of officers working in harmony and together, and with some distinct aims and objects in view, and the information which they collect must be put into such form as will be of use when the army is called into active service.

We are all familiar with the description of how Von Moltke, when informed that war had been declared against Germany by some one of the Continental powers, could turn to his aide-de-camp and direct him to open such a drawer in his cabinet in order to obtain the plans of the campaign against that particular power. We are familiar, I say, with this description, and have expressed our amazement at the thoroughness with which the Germans have devoted themselves to the study of everything pertaining to the art of war, and yet we have failed to grasp the real point of this story, and do not see that if all these plans and

preparations are necessary, the means of providing them must be furnished and that it is impossible to emulate the Germans in this particular unless we have some body, such as a staff school, where these problems can be studied.

Colonel Furse says on this point, that just because the particular instruction of the soldier in time of peace is a far easier matter to undertake than the training of the administrative services in all the intricacies connected with the proper maintenance of an army in the field, we must strive to devise some system by which the officers of the latter may become familiar with the abnormal conditions of war.

Many useful lessons can be derived from the careful study of all wars, and the weak points in the organization of an army are unusually emphasized by the results or misfortunes of the war. Every army, save ours, has a department whose duty it is to study the various wars and derive such useful lessons as they can from the same, and particularly from the campaigns which have been entered upon by their own armies.

No careful analysis has ever been made of our last war to ascertain such measures as were found practical and which yielded good results so as to incorporate such matters in our regulations.

The following are the titles of the chapters treated in this work:

Chapter I. General Observations on the Communications of an Army in the Field.

Chapter II. Staff of the Lines of Communication.

Chapter III. The Station Commandants.

Chapter IV. The Commanding Royal Engineer.

Chapter V. The Ordnance Store Department.

Chapter VI. The Army Pay Department.

Chapter VII. The Assistant Provost-Marshal and Military Police.

Chapter VIII. Protection of the Lines of Communication.

Chapter IX. Civil Administration of the Occupied Territory.

Chapter X. Sea-Base of Operations.

Chapter XI. Alimentation of an Army in the Field.

Chapter XII. Requisitions.

Chapter XIII. Magazines.

Chapter XIV. Food and Forage.

Chapter XV. Water.

Chapter XVI. Transport.

Chapter XVII. Location and Removal of the Sick and Wounded.

Chapter XVIII. Depots for Remounts and for Sick Animals.

Chapter XIX. The Electric Telegraph and other Means for the Rapid Transmission of Orders.

Chapter XX. The Field Post.

From which it is evident how completely Colonel Furse has covered this subject of the method of supply of troops in the field. It

is difficult to resist quoting extensively from this book because it is so important, so I may be pardoned in giving the following extracts:

"Doubts have been expressed with regard to the possibility of finding an officer capable of supervising all the administrative details of an army in the field; nevertheless no one has questioned heretofore the possibility of finding a general able to control both the military operations and the supply of his army."

"It is strange that in Continental armies, in which hundreds of thousands of men are placed in the field, no greater difficulty is experienced in finding an officer capable of assuming the supreme direction of the administrative services."

"There are some individuals who appear greatly exercised by the idea that the general of communications would have to control officers who know more about certain subjects than himself. Besides that this objection would equally apply to the general commanding or to his chief of staff, it is necessary to point out that the word is willfully misapplied, for, in reality, it was never contemplated that the general of communications should control the various services. The real object is that he should make them dovetail their work for the general good. Does not a commander on the battle-field have to direct the efforts of the artillery, the cavalry, and the infantry; still, as he only belongs to one branch of the service, are not many of his lieutenants better acquainted than he is with their special arm?

"It is not a distrust of the administrative departments, but their absolute autonomy in time of peace, which makes it essential, when they are brought together to work out the difficult problem of maintaining an army in the field, that they should be placed under the direction of an experienced officer, of an officer of high rank, who is not burdened with any other matters. This arrangement aims at only one officer—not a departmental officer, but a carefully selected staff-officer—being responsible for the harmonious working of the whole administrative staff, and it is that officer's sole business to see that the army is supplied with everything it requires. This does not relieve the general commanding from any responsibility; he will doubtless place trust in the ability of the officer in charge of the communications, naturally, therefore, he becomes responsible for the trust he reposes in him."

"The extensive knowledge required to attend to the direction of the communications can only be acquired by a long period of service on the staff of the army, by experience in war, and by study. With regard to the last point, it may not be considered irrelevant to impress on all officers alike the necessity for acquiring by study a fair knowledge of those administrative details which conduce to the maintenance of an army on active service. An officer should not rest satisfied with knowing simply how to drill his men and how to manœuvre; he must

go deeper in the study of his profession, for, undoubtedly, how to overcome all the difficulties which attend the systematic provision of all that an army requires to keep the field with credit constitutes the most perplexing part of the art of war."

"A very important matter is the protection of the communications, and here it seems but rational that the officer who is intrusted with the charge should likewise have command of the troops detailed for their security. What officer can be in a better position for knowing the dangers which threaten any part of his line or can have a deeper interest in taking precautions to avert them? Unquestionably the charge of the lines of communication, and of the troops that have to secure their undisturbed possession, must go together; the general of communications must be absolute there, and cannot be dependent upon the co-operation of another officer. Were the command of the troops on the communications taken away from him, he would sink at once into a purely administrative officer; whilst the separation of the duties of supply and command would engender a dangerous division of responsibility. His troops, among other duties, have to uphold his authority, and often to enforce his demands; and these duties cannot be efficiently performed unless they are entirely at his disposal.

"The appointment of an officer simply to undertake the protection of the lines of communication would be injurious, inasmuch as it would make the station commandants and many other officers subject to two masters."

In conclusion, I desire to say that there is no one connected with our army, from a general down through all grades in the line and including every officer in all the staff corps and also the chaplains, who will not be benefited by a perusal of this book. It is a subject which is of as vital importance to a line officer as it is to any member of the staff corps, and while it may not be necessary for line officers to go into all the details of the subject whereof this book treats, it is necessary for them to know something of it in order that they may be able to perform their part intelligently and satisfactorily when on active service.

This book should be made a text-book in our post-graduate schools, and, if so, the army as a whole might be brought to see the necessity for the organization of a staff school wherein all these matters could be studied with the greatest elaboration.

Colonel Furse has selected the following from Home's "Précis of Modern Tactics" as the motto of his book,—viz.:

"When war is declared, the time for preparation, the time for training is past, the day of action has come. If the weapon is not well tempered, wants edge, and is useless, the responsibility rests with those who have allowed it to become so."

HENRY G. SHARPE,
Captain and C. S., U.S.A.

ORIGIN AND DEVELOPMENTS OF STEAM NAVIGATION.

(Continued from Vol. XII., page 576.)

1881.—AN HYDRAULIC SHIP, built in Germany in 1881, on her trial accomplished nine knots an hour. Two hundred years before that the experiment was made of propelling vessels by expelling water from the stern, and failed, as sufficient speed was not attained. This new method is based on the assumption that the propelling force depends on the contact of surfaces, and not on the sectional area of the flowing mass, so a number of tubes with narrow outlets are used instead of one large tube.

1881.—A NOVEL PROPELLING POWER.—A steam-yacht with a novel propelling power was built in 1881. Instead of a screw, as in ordinary propellers, there is a flat blade of iron under the rudder at right angles to the keel. This blade was hinged in the centre. The blade worked backward and forward on a hollow shaft, with a stroke of three feet forward and aft. As the blade moves forward under the overhang of the vessel, by means of an inside shaft, it shuts up, and makes no resistance to the water. When it goes back again it opens, and virtually pushes the water astern. As the engine can work the blade with a stroke of one hundred and twenty to the minute, it is calculated that extraordinary speed will be attained. The yacht is about thirty feet long over all, and is provided with a patent engine resembling a pump-engine, with a pump-cylinder. The propelling-blade or pusher is three feet in length and fifteen inches wide.

1881.—THE "MONARCH."—The first freight steamer to engage in the interoceanic trade arrived at San Francisco in 1881. She left Barrow, England, on the 31st of August, 1881, and stopping to coal at the Cape Verde Islands, and at Coronel, on the West Coast of South America, arrived at San Francisco on the 8th of September, having been sixty-nine days on the passage. She had as freight on her voyage 2000 tons of steel rails, and it was the result of the desire of railroad builders on the Pacific slope to get the equipments needed as speedily as possible. The shipment might have been made by a sailing vessel at not over $5 per ton, but in this case it is understood $16.75 were paid, making the shipment cost, when landed, over $20,000 more than would have been the case under ordinary conditions. The "Monarch"

was chartered before her arrival in San Francisco to carry a load of grain to Liverpool, at £3 17s. 6d. per ton, a trifle over that paid to sailing vessels when the contract was made. Premising that the steamer carries the same weight of grain she has of rails, her gross freight money would amount to about $72,000 for the round voyage. Out of this, deducting the money paid for coal, and assuming that she consumed twenty-five tons of fuel each day, which would cost, when on board, not less, on an average, than $10 per ton,—not a high valuation, considering that the coal was taken in large part at outlying stations,—and that she steamed on the round voyage one hundred and twenty-eight days, this would amount to $32,000, leaving $40,000 for ordinary running expenses and profits. A sailing vessel, which carried an equal amount of cargo would, with freight-rates as they have been, obtain for making the same round trip $22 per ton, which would give a gross freight of $44,000, or ten per cent. more than the sum made by the steamer after deducting coal charges. The saving to the steamer would be that she could make five round voyages while a sailing vessel was making three. But it must be remembered that steamers are not likely to have the same favorable outward freight offered to them. If they can only command 2s. 6d. more per ton than sailing vessels in carrying a perishable article like grain from San Francisco, it is safe to assume, that as a rule, they will not get more than the slower craft for carrying steel rails or other outward cargo. The conclusion to be drawn is that for the present steamers cannot profitably compete with sailing vessels on such a long route as that between California and Europe.

1881.—Cost of Ocean Steamships in England.—The following were the prices per ton paid for screw steamers built, equipped, and ready for sea in 1881 by builders on the Mersey, Clyde, and east coast of England, suited to the trade indicated; and the enormous losses by wreck and foundering have resulted in a sober second thought; and the lead-pencil type model, long and narrow, says an English paper, is giving place to more beam. The length and contracted breadth, with a profusion of water ballast, is compelled to give place to more beam and greater stability:

Trade.	Class.	Net Tonnage.	Knots per hour.	Consumption of coal, 24 hours. Tons.	Price, U. S. Gold.
Cargo Steamers:					
Adapted for general Atlantic trade	100 A 1	1484	10.5	28	$167,894
Especially fitted for cattle . .	100 A 1	2000	10½	36	214,126
Especially fitted for cattle . .	100 A 1	. .	11	24	223,859
For general and cattle trade .	20 years L	2000	10½	25	243,325
Three-decked rule	100 A 1	1500	10	27	170,327
Spar deck	20 years L	1370	10	16	175,194
And passengers if required .	100 A 1	1349	9½	20	160,594
Also suitable for cattle . . .	100 A 1	1130	9½	17	128,962
" " . . .	100 A 1	1090	9	12	131,395
" " . . .	100 A 1	910	9	10	107,063

Trade.	Class.	Net Tonnage.	Knots per hour.	Consumption of coal, 24 hours. Tons.	Price, U. S. Gold.
CARGO STEAMERS:					
But easily arranged for passengers	100 A 1	916	9½	12	$105,608
Awning deck especially built for cotton	100 A 1	1270	9¾	13	145,995
Awning deck especially built for cotton	100 A 1	2060	13	35	291,990
Spar deck for Atlantic trade .	100 A I & 20 years L.	1747	11	28	184,927

1881.—THE LARGEST TORPEDO-BOAT afloat in 1881 was built in England for the Danish government by Messrs. Thornycroft & Co. Her displacement was fifty-five tons, or forty per cent. more than that of the largest torpedo-boats in the British service; but her dimensions were still within the limit which would permit her to be conveyed by rail from one part of the coast to another. Her armament consisted of four of the largest Whitehead torpedoes, each of which carried a charge of eighty pounds of gun-cotton, and, in addition, she mounted a Hotchkiss revolving gun. She had a coal capacity of ten tons, estimated as equivalent to 1200 miles, at a speed of eleven knots, and her full speed, as shown at the trial, as well as during a run of three hours at the measured miles, was twenty knots, which was two knots in excess of the stipulation.

1881.—The "DESTROYER."—The first public exhibition of Captain Ericsson's torpedo-boat, "Destroyer," was made at Hoboken, November 14, 1881. Several prominent officers of the army and navy were present. The chief object of the exhibition was to demonstrate the practical working of the submerged gun, by which the torpedo missile is sent upon its deadly errand; also to show the ability of the torpedo to penetrate protective net-work around a fleet or a single ironclad.

A dummy projectile of wood was used without a torpedo charge. In the test the dummy was discharged from the cannon by the use of twelve pounds of giant powder at a target net of Manilla rope and wooden slats three hundred feet distant. The muzzle was six feet and six inches below the surface, and the projectile passed through the target five feet under water, appeared on the surface one hundred feet further in shore, and rode on the water at a considerable speed for two hundred feet more, making a distance of six hundred feet traveled in all. The *projectile*, which was *twenty-five inches in length*, traveled through the water to the point of appearance on the surface, four hundred feet, in three seconds, and this with a charge of but twelve pounds of powder. The gun is fired by electricity by the wheelsman, who, through his lookout, must aim and discharge the gun in accordance with his best judgment as to effectiveness. The experiment was

under the direction of V. F. Lassoe. It was the fifty-second time the gun had fired the projectile, and at no trial since the boat has been put in working order has it failed with the same charge to throw the dummy torpedo three hundred feet in three seconds or less. The French officers were especially interested in the experiment, and though they at first pronounced it an impossibility to operate a gun constructed on such principles, and with submerged muzzle, successfully, they were obliged to acknowledge that the theory had proved correct. Astonishment was depicted in every line of their countenances when they saw the projectile rise to the surface beyond the target, after having traversed the distance from the muzzle of the gun and through the netting without making even the faintest ripple on the surface.

In actual service the torpedo projectile is to carry three hundred and forty pounds of dynamite,—enough to destroy the largest ironclad. The gun will be discharged with a force sufficient to carry the projectile from three hundred to seven hundred feet through the water.

1881.—THE FALL RIVER LINE.—The "Bristol" and "Providence," of the Fall River Line of Sound steamers between Boston and New York, for size, proportions, and general magnificence of appointments have attracted the attention and admiration of travelers from every portion of the world. They are 373 feet long, 83 feet beam, 3000 tons register, and cost $1,250,000 each. During the Centennial season, 1876, the passengers carried in safety and comfort by these mammoth steamships were numbered by hundreds of thousands. Over one thousand persons frequently made the trip in one of these steamers without discomfort or crowding. The fresco-work and gilding of the interior is elegant and elaborate, the shading and coloring having a most harmonious and beautiful effect. The main saloons, galleries, and cabins are carpeted richly and tastefully, and the furniture elegantly upholstered. All the state-rooms are connected with the main office by electric bells. Some idea of the size of their engines may be formed when it is stated that the Corliss engine, which attracted so much attention at the Centennial, was not one-half the size nor had one-half the capacity of the engines on either the "Bristol" or "Providence." In provisions for safety the arrangements are perfect. Every portion of the boats where fire is used is absolutely fire-proof, and each steamer is provided with all the improved life-saving appliances.

The "Pilgrim," the new steamer launched August, 1882, from Roach's yard for this line has 300 state-rooms and accommodations for 1000 passengers, and is 15 feet longer and 4 feet wider than the "Bristol." She is 384 feet long over all; 370 feet long at water-line; 87 feet wide over guards, and 17 feet 6 inches deep at sides. Her double hulls are divided into 96 water-tight compartments, bearing a pressure of 5 pounds per square inch. Steam is supplied from four Redfield boilers, and there is one immense beam-engine, having a cylinder

110 inches in diameter, with 14 feet stroke. This cylinder was cast at Mr. Roach's Morgan Iron Works, in New York, and is said to be the largest cylinder ever cast in this country. It required 45 tons of gun-metal, which it took three hours and ten minutes to melt. The 90,000 pounds were then transferred by the labor of 100 men to two huge tank-ladles, each with a capacity of about 14 tons, and having two large crane-handles. The tanks were connected with the mould by pipes, and the crane-handles were attached to huge cranes. The mould was filled, under Mr. Roach's personal supervision, in two and a half minutes, the molten metal roaring like a wild beast, and emitting showers of twenty colors. It required about ten days for the metal to thoroughly cool, and for several days it remained red-hot. When perfectly solidified the upper part of the mould was demolished, and the cylinder dug from its resting-place in the ground. The two main shafts for this engine are 40 feet long and 27 inches in diameter, forged from wrought iron, and each weighing 85,000 pounds.

1881.—STEAMSHIP DISASTERS.—As the tonnage of the merchant steam marine increases, so do disasters of steam-vessels grow. The records of 1881 show the disasters to steam-vessels for the year to have been 198. A dozen of these were repaired and put into service, but nearly all were total wrecks. A few were also sunk at their piers through carelessness while loading or discharging cargoes, as in the case of the "Braunschweig," loading coal in the harbor at Bremen. Others were stranded and floated off without receiving damage. Included in the record for 1881 is the loss of the Polar expedition steamer "Jeannette," in the Arctic Ocean.

The record for 1881 shows 141 of the disasters were to British steamships; 15 were American; 6 French; 6 Danish; 5 German; 3 Dutch; 4 Swedish; 1 Brazilian; 3 Belgian; 4 Spanish; 2 Chilian; Mexican, Chinese, Austrian, Japanese, and Norwegian, 1 each; of 3 the nationality could not be learned. Of these, 4 were of steel, 5 of wood, and the remainder iron vessels. The total tonnage lost in 1881 was 200,000 tons, 151,041 tons of which were British; 11,568 American; 4390 Dutch; 2488 Swedish; 1000 Brazilian; 6486 French; 4643 Belgian; 3274 Danish; 4562 German; 4177 Spanish; 680 Mexican; 1233 Chinese; 808 Austrian; 947 Japanese; 697 Norwegian, and 1750 Chilian. Of the disasters, 99 vessels were stranded; 30 sunk by collision; 40 foundered; 7 burned; 11 are missing; 6 were abandoned at sea; 2 were sunk by ice; 1 broken in two, and 1 was destroyed by explosion. Eleven of the vessels were laden with grain; 23 with coal, 11 with iron; 2 with cotton, and 1 each with copper ore, petroleum, provisions, wool, and sugar.

The greatest number of disasters were in October; the records for that month are unprecedented, the total number lost being 32, of which 18 were British; France, Germany, and Norway lost 2 each;

Austria, Belgium, Brazil, Chili, Holland, Russia, Spain, and Sweden, 1 each. It is estimated that no less than 43,033 tons of produce were lost in the October gales.

The steamship "Bath City" foundered off Newfoundland, December 3, 1881, and the sufferings of the crew were terrible. Sighted on November 30, two hundred and fifty miles from the port of St. John's, Newfoundland, by a steamship which could have assisted her into port, she was left mastless, rudderless, and leaking, to her fate, which came three days afterwards. The vessel went to the bottom, and the crew were launched on the stormy ocean in their life-boats. Four were drowned by the capsizing of one of the boats, and six, including the captain, perished from cold and exposure. The other castaways, having suffered three days and nights in these open boats, were rescued.

1881.—BRITISH STEAMSHIP SUBSIDIES.—The report of the British post-office for the year ended March 31, 1881, states the sums paid to various steamship companies for the conveyance of the ocean mails, together with the receipts from ocean postages and the net payments under the several contracts during that year, was as follows:

Countries.	Contract Compensation.	Receipts from Postages.	Net Payment by the Government.
East Indies, China, and Japan . .	£356,900[1]	£60,000	£208,000
East Coast of Africa	30,000	500	29,500
United States	65,311	38,000	27,000
Halifax, Bermuda, and St. Thomas	17,500	1,000	16,500
West Indies	84,782	35,000	50,000
West Coast of Africa	7,969	6,000	1,900
	£562,462		
	Estimated	£140,500	£332,900

For the service in the English Channel, between Dover and Calais, the sum of £11,274 were paid for the same year; and for the service in the Irish Channel, between Holyhead and Kingstown, £85,000 were expended, a sum equal to more than one-quarter of the total net payment by the government for its ocean postal service.

The service to Brazil coast the government nothing, the postage earned having been sufficient for the compensation asked for. Nearly the whole of the expenditure specified was made for the maintenance of postal communication within the limits of the British empire. Besides which several of the colonial governments are under contract with steamship companies for their own immediate ocean mail service.

AUSTRIAN STEAMERS.—The first Austrian Lloyd steamer for New York sailed from Trieste, January 25, 1881. She was to touch

[1] Of this amount, £88,000 were contributed by the government of British India.

at Messina, Palermo, Barcelona, Malaga, Cadiz, and Lisbon, and had on board a full cargo, 600 tons of it being for New York.

1882.—"THE PEACE."—A missionary steamer, whose hull and machinery weighed only six tons, was recently moored in the Thames, near London. The vessel was named "Peace," and was built for the Baptist Missionary Society, who destined it for the service of the mission in the upper reaches of the Congo River. The boat could be taken to pieces rapidly for transport purposes, and the total number of pieces, none of which were too heavy for a man to carry, were eight hundred. The greatest possible use was made of all available space, and the two cabins were admirably fitted. A kitchen adapted for a stove and other cooking appliances formed part of the equipment. A substantial awning covered the deck, and between this and the sides of the vessel a wire awning was fitted to stop arrows and other missiles. It was intended to take the steamer to pieces and pack the sections in boxes, which would be sent to the mouth of the Congo. From thence they were to be borne by eight hundred men three hundred miles up to Stanley Pool, where the steamer would be reconstructed by the missionaries.

1882.—THE "COLOSSUS."—The latest addition to the British royal navy is the double-screw steel armor-plate turret-ship "Colossus," launched at Portsmouth, March 21, 1882. She is of 9146 tons burden, and her engines are of 6000 horse-power,—a striking advance upon Fulton's "Clermont," the wonder of three-quarters of a century ago.

The "Colossus" has been in process of construction for some eight years past, but the work on her has been seriously pressed only since 1879. She is a twin-screw turret-ship, with a central armored citadel, her principal dimensions being: total length between the perpendiculars, 325 feet; extreme breadth, 68 feet; with a displacement of 9146 tons. Considerable delay has been experienced with respect to the turrets, which cannot be proceeded with until the nature of their armament is determined. It is probable that each turret will be armed with two of the new 46-ton breech-loading rifle-guns. A novel feature in the armament of the ship will be the mounting of four 6-inch guns on the top of the after superstructure, and a couple of guns on the forward superstructure, with rifle-proof covering-boards for the protection of the gunners.

The vessel is to be fitted with a manganese bronze propeller, in place of the one of gun-metal originally ordered. This decision was arrived at after a series of comparative experiments made with the two metals. Bars of both metals, one inch square, were placed on supports twelve inches apart, and first subjected to a steady pressure applied in the middle of the bars, and afterwards to impact, by a weight of fifty pounds falling from a height of five feet. With a steady pressure the

gun-metal bars slipped between the supports or broke with a strain of twenty-eight hundred-weight, while the manganese bronze bars required fifty-four hundred-weight to break them. Tested by impact, the gun-metal bars broke with from seven to eight blows, when it took from thirteen to seventeen blows to break the manganese bronze bars. The ultimate bend of the latter was also in both cases more than that of the gun-metal, thus showing fully double the strength, with superior toughness. The advantages claimed for the manganese bronze over gun-metal are, first, a considerable saving of actual weight of machinery; and, secondly, that it enables a thinner and consequently a better blade to be made, offering less resistance to the water, and equaling in strength the gun-metal blade of greater dimensions.

Since the launch of the "Colossus" another ironclad, to be called the "Rodney," has been laid down and commenced at the Chatham Dock-Yard. She is to be a barbette ship, and will carry ten heavy guns. Her length between the perpendiculars is 325 feet; extreme breadth, 68 feet; depth of hold, 28 feet 2½ inches. She is to have engines of 7000 horse-power, and will have a gross tonnage of 9158 tons.

1882.—THE "DUNCAN" AND THE "CAMPERDOWN."—The English government, having determined to build two ironclads which will match the Italian ironclad "Duilio," on the 26th of September, 1882, the Admiralty ordered the construction of two ships, to be named "Duncan" and "Camperdown," of the following dimensions: Length, 330 feet; extreme breadth, 63 feet 6 inches; displacement, 10,000 tons on a mean draught of water of 26 feet 9 inches. These new ships are to have twin screws, with engines of 9800 horse-power, estimated to give a speed of 16 knots an hour, being an excess of two knots over the Italian turret ship. The "Duilio" is 341 feet long. Her extreme beam, 64 feet 9 inches, and displacement, 10,434; her engines being of 7500 indicated horse-power. The armor of the English ships will be carried to a depth of 5 feet below the water-line, with a protecting belt rising 2 feet 6 inches above the water-line, the armor comprising compound plates of the following thickness: side, 18 inches; bulkhead, 16 inches; barbette towers, 14 and 12 inches. They will have vertical ventilation by tubes from the flying to the lower decks. As at present determined upon, their armaments will each consist of four 63-ton breech-loading rifle guns, and six 6-inch breech-loading guns, with a number of Nordenfelts and Gatlings, and Whitehead torpedoes. They are to carry 900 tons of coal, and their complements will consist of 450 officers and men. Their cost is estimated to be not less than £1,000,000 sterling each, or two-thirds of the amount which is appropriated for the annual expenditure for the whole navy of the United States.

1882.—NEW FRENCH IRONCLADS.—As a result of a number of experiments lately carried out in France with armor plates of a variety of patterns, and obtained from various sources, both French and foreign, a contract has been concluded between the Minister of Marine and the managers of the Creusot Works for the supply by the latter of the armor for the "Formidable" and the "Capitaine Baudin," two new ironclads of 11,441 tons each, or of almost exactly the same size as the English "Inflexible;" the displacement of the latter being 11,406 tons. The plates are to be 22 inches thick at the strongest, and 14 inches thick at the weakest part of the armor; and consequently the new French vessels will be defensively stronger than any English ironclad at present either afloat or being built. The Creusot firm is also at the present time supplying the armor plates for the "Terrible," a vessel of 7184 tons, and for the "Furieux," a ship of 5695 tons; the plates for both the vessels being nearly 20 inches thick.

1882.—Among the costly steamers built at Pittsburg, Pa., in 1882, none possess more points of interest than the "Chattahoochee." Her hull is the first constructed *entirely* of steel in this country. Steel hulls have been built in Pittsburg, but in these the braces, angles, etc., were of iron. In the "Chattahoochee" steel is solely used. The steel plates used vary from a "light" three-sixteenth inch in thickness up to one-fourth inch, according to their locality in the hull. The contract for the boat was let to the Duquesne Engine Works, by the People's Line, of Columbus, Ga., for $47,000. The trade calls for a boat of light draught, strength, and speed, and these seem all embodied in the "Chattahoochee." Her hull is 158 feet long, 31½ wide, and 4½ deep. She is a stern-wheeler, with engines of 15-inch cylinder and 5-foot stroke, fitted with the Rees "cut-off" and other modern improvements. Her wheel is eighteen by twenty-four feet, with a steel shaft. There is more steel about the "Chattahoochee" than any other boat of her size afloat. Five electric lights make the "Chattahoochee" a thing of beauty by night. Her draught is only twenty-two inches.[2]

At the steam-yacht race at Nice, France, on the 16th of March, 1882, nine yachts competed for the *Prix de Monte Carlo*, or $1000 and a gold medal. Eight were English, and the smallest, the "Le Few-Follet," of French nationality. The course was fifty miles long; and done in three hours, fifty-six minutes, and ten seconds,—a speed about thirteen and seven-tenths knots per hour. The "Condace," built in Leith and engined in Glasgow, Scotland, won the first prize; the "Black Swan," engined by the same firm, took the second; the "Le Few-Follet," the third. Only two yachts contested in 1881, and the increase in 1882 indicates the future of steam-yacht racing.

[2] This steamer should not be confounded with one of the same name launched in 1882, by John Roach, at Chester, for the Ocean Steamship Company of Savannah.

In 1882 the little steam-tug "Game Cock," a craft only seventy-five feet long, — feet wide, and drawing eleven feet of water, steamed from London to Panama in thirty-one days. She indexes in a marked manner the wonderful improvements made lately in the efficiency of steam-craft. The recent introduction of steel as a building-material in the construction of these "lightning" steam craft—torpedo-boats, launches, etc.—has made results probable that a short time ago were thought impossible.

1882.—CHAIN-STEAMERS.—The Leipsic *Gartenlaube*, June, 1882, contains an interesting article on chains used in the navigation on the Elbe River. The following are the main points of the article:

On the waves of the Elbe, impatiently floating towards Hamburg, a steamer goes up the stream, pulling along a long row of heavily-laden boats. But it is not only the force of steam that conquers the stream. Below, on the bottom of the river, a heavy iron chain is resting, that gives the steamer a hold, and enables her to overcome the force of the water. From this chain such vessels are called chain-steamers, and the whole navigation going on in such a way is called chain navigation.

In the middle of the channel, along the whole length of the navigable part of the river, a chain has been sunk, firmly anchored at its two ends. This chain, lifted out of the water, is received by an arm at the bow of the vessel, and thence by conducting rollers moved to two steel drums in the middle of the deck. Around these drums, provided with grooves, the chain winds three times in such a manner that it goes from the first groove of the first drum to the first groove of the second drum, thence to the second groove of the first drum, and then to the second groove of the second drum, etc. Finally the chain, in a conducting groove obliquely descending, is taken to the stern of the ship, where it goes down into the water again. The engine sets the two drums in motion, and all the parts of the drums encircled by the chain receive and dismiss an equal portion of it, moving the vessel forward a corresponding distance.

The chain on the bottom of the river to which the steamer is attached by the two drums, so that she can go only forward or backward, is, according to the pulling force of the ship and the depth of the water, lifted a certain length in front of the vessel. The point where it remains unlifted is, as it were, the anchoring point of the vessel, the weight and friction of the chain supplying the anchor. The chain-steamer, with the whole load of vessels attached to and towed by her, is thus, as it were, constantly at anchor on going up the stream, and she cannot, even by the most rapid current, be forced back one inch of the way made. Because the vessel by the chain firmly resists the water, the power of the engine can be used to its fullest extent.

The chain, of course, does not rest tightly in the river-bed. The raised portion of it permits the vessel, by means of the rudders, to go sufficiently far to the right or left, out of the way of other vessels. This is of particular importance at the bends of the river.

On account of the burden caused by the lifting of the chain, the depth of the water must not exceed a certain limit. In a river from thirty to fifty feet deep chain navigation would not be profitable, because the chain would become too heavy. As to the use of chain vessels, a depth of eight metres has proved a practical limit of the depth of the water. The essential advantage of chain navigation consists in the fact that it permits vessels to go up a stream with a very rapid current, where other tow-boats cannot go along any farther with the barges attached to them.

It is self-evident that the strength of the chain must correspond to the depth and rapidity of the river. The links of the chain placed in the Elbe have the size of the palm of a hand, and are of two and one-half centimetres thick, each link weighing a little over one kilogramme. The weight of the chain placed in the Elbe River exceeds ten million kilogrammes.

The chain-steamers have the same shape at both ends, and are provided with two rudders, one at the bow and one at the stern. The engine usually has a strength of from one hundred to one hundred and fifty horse-power. To a chain-steamer in the Elbe usually from ten to twelve freight vessels are attached, connected by ropes. She takes the train of boats up the river, until another chain-steamer meets her and relieves her of her load. Such a place is made a station, and may be any point of the chain. The relieved motor returns until it meets another train of vessels coming up, which it receives in turn in the mode described, towing it up the stream. In order to move independently of the chain, the majority of the steamers are provided with propellers. For detaching a steamer from the chain simply one of the locks of the chain is opened, with which it is regularly provided in intervals of half a kilometre. Or, if necessary, a link of the chain is broken by a chisel, and after the chain has been taken off from the drums, its two parts are united again by a lock.

The first chain-steamers were successfully used in France in 1830. E. Bellingrath, of Dresden, inventor of the hydrostatic truck, is the chief of the chain navigation in the Elbe River, Germany. The Elbe River rises in Austria (Bohemia) and flows through the central part of Germany into the North Sea. In the latter country six hundred and thirty kilometres and in the former about forty kilometres of chain have been placed in the river, while the number of chain-steamers is about thirty.

The chain does not always occupy the same place in the river, but its position is constantly changed by the steamers. For this reason

only one can be used in the river. Two or more chains or ropes made of metal wires would become entangled.[3]

1882.—THE HOPPER STEAM DREDGER.—This new dredger, built at Renfrew for the Harbor Commissioners of Otago, New Zealand, was recently tried on the banks of the Clyde,[4] "and dredged at the rate of 400 tons per hour, which was plunged into its own hold, or hopper cavity, capable of containing 1300 tons of soil; at the same time it loaded the new government steamer "Perseverance," which came alongside. Afterwards, by steam appliances, its bucket-girder was elevated, the moorings let go, its twin screws put in motion, and the vessel steamed away down the Clyde to the measured mile, where the loaded speed was tested at 7½ knots per hour; it then steamed down the Firth of Clyde, where its large cargo was instantly deposited, through its bottom, in sixty fathoms water. The trial of dredging, steering, speed, manœuvering, and depositing was considered very satisfactory by the respecting gentlemen on board. This vessel dredges from 5 feet to 35 feet depth, has twin screws, and is propelled and worked by two independent sets of compound engines, of 700 horse-power, and, besides loading its own cargo, it can, if required, fill a fleet of barges on the old system. It will steam out to New Zealand, and is the tenth and largest Hopper dredger constructed by Messrs. Simons & Co., who are the inventors and originators of the system. It is also worthy of note that, owing to the enterprise of the above small colony, they have now a dredger the equal of which is neither in Europe nor America."

1882.—THE RAILROAD IRON FERRY-BOAT "NEWBURGH," built for the West Shore Railroad Company, was launched in October, 1882, at Newburgh, the christening being by Miss Carrie Fry, daughter of the superintendent of steam motive power of the railroad. The dimensions are: Length over all, 205 feet; breadth of beam, 36 feet; over

[3] Experiments have been recently made on the canal from Antwerp to Liége with a system of mechanical traction of boats by means of a moving cable (the invention of M. Rigoni). An endless cable made of Bessemer steel is set in continuous motion by fixed engines on the banks of the canal. It is supported along the bank by special pulleys, and directed by return pulleys of large diameter lodged in chambers of masonry under the level of the tow-path. The length of the cable is eight kilometres, or five miles. Thus a canal is divided into as many sections, each worked by a fixed engine, as this length of five miles is contained in it. The steam-engine acts on the cable through a pinching-pulley, similar to the Fowler pulley. The attachment of the boats to the cable is by means of checkered nippers embracing the cable. On coming to a supporting pulley, or a pulley at a curve, the nippers pass without releasing the cable. The principal advantages of the system are, first, a considerable increase of speed. At present the daily stretch covered in hauling with horses is about seventeen kilometres, and with men only about twelve kilometres. By the new method it is easy to make five kilometres an hour. Further, there is considerable economy both in the capital required at first and in the cost of working over other systems.—*Boston Transcript*, November 1, 1881.

[4] *London Engineering*, October, 1882.

the guards, 65 feet; depth, 14½ feet. Her hull is of the best quality of iron, and of great strength, as she will have to contend with heavy ice in the winter. The keel-plate is ¾ inch thick, the bottom and bilge-plates ½ inch, the water-line strake ⅝ inch, shear strake $\frac{7}{16}$, and the gunwale-plate ½ inch by 24 inches wide. The frames are 3 x 4, spaced 21 inches apart, and the reverse iron is 3 x 3. There is a 10-inch belt frame on every eighth frame, and the floors are 16 inches deep. The stem-posts are of the best hammered iron, 8 x 4 inches. Each end of the hull is fitted with a water-tight, wrought-iron bulkhead, extending for about 30 feet from the stem; there are 4 keelsons, running from bulkhead to bulkhead, and the bottom of the hull inside is cemented with the best Portland cement.

The motive power of the vessel is a vertical beam engine, of 50 inches bore by 10 feet stroke, fitted with Hayward's patent cut-off. The gallows frame of the engine is of iron and of great strength. The water-wheels are wholly of iron, 21 feet in diameter and of 8½ feet face. The shafts are 15 inches in diameter, each one, with its wheel, weighing, complete, about 26 tons. The boiler is of steel, 10½ feet in diameter, and 33 feet long, with two furnaces, and weighs about 30 tons. Everything about the engine and boiler departments is of the newest and best description. In short, the boat is all that experience and skill can make her, for safety, utility, and comfort.

The cabins on two sides of the boat are made very inviting. They have tile floors; the wood-work is in the Queen Anne style, of California red-wood, cherry, and mahogany, finished in oil and touched with gold. The seats are of perforated veneering, with "Austrian bentwood arms." The windows in the sides of the cabins are each one single light of plate glass, 6 feet high and 3 wide, with a transom of stained glass above. The doors to the cabins are of mahogany, with stained glass transoms overhead; the wheel bulkheads are each provided with two large bevel-edged mirrors. She was to be completed about the 15th of December.

Recent Novel Inventions and Experiments.

1882.—Morse's Unsinkable Steamship.—Mr. Joseph W. Morse, a veteran artist and engraver of Brooklyn, New York, has invented a safety ocean steamship, which he claims is unsinkable. He says he conceived the invention twenty-five years ago, and built a model of it nine years ago, which he kept in his office in Franklin Avenue, where many persons saw it. He thinks that Lorrillard and others who are building the "Meteor" are infringing upon his invention, and that it probably suggested the idea of the dome steamer. Last July, describing his vessel to a visitor, he said, "One advantage I have over the proposed new line is that my vessel *cannot be sunk*. No matter how heavy a storm may be, she will ride it safely. If she should run

into an iceberg, or collide with another vessel, it would be impossible to sink her.

"Her safety will not consist in numerous air-tight compartments, but why it will be impossible to sink her is my secret. You can look at the model," he added, pointing to it standing on a table in the corner of the office.

The model boat is that of a low, rakish-looking vessel. The principal feature is that she has no deck, being rounded on top after the manner of the lower part of the hull. The bow tapers gradually from the centre, after the fashion of a steam-yacht. There is also a gradual tapering from the centre to the stern, which overhangs the rudder to some extent, but the stern is as sharp as the bow. The vessel is a long, narrow cylinder, sharpened at both ends, the lines being neatly and artistically drawn. She has two tall smoke-stacks, leaning fore and aft.

"You see," continued the inventor, "she is built for speed as well as for safety. Having no rigging, and with her shape, she will meet with little resistance of either wind or water. She is modeled so that she will glide through the water with scarcely a ripple. The water will run along her bottom with as much ease as though running down hill. Her upper part is built on the same principle, so that the speed will not be impeded by the wind. There will be no projections from the upper part, save the pilot-house and smoke-stack. They will be built of iron and strongly braced, and modeled in the same manner as the vessel. You will notice that I have studied the wind as well as the water, and speed as well as safety. A steamship built after my model will make a voyage to Europe in one-quarter less time than the fastest steamship afloat at the present day.

"That apparent forward smoke-stack is the pilot-house. The vessel has but one smoke-stack. The pilot-house being on a level with the smoke-stack, the pilot will have a longer range of vision, and be beyond the reach of the sea in case of storm. The pilot-house and smoke-stack will be forty feet above the surface of the water, about the usual height of a look-out on a vessel. Below the pilot-house there will be an opening for the purpose of pumping air into the ship. This pure air will be continually passing through the ship, and out again through the smoke-stack. Aft of the pilot-room, in the stack, will be an elevator for the transportation of the men up and down."

The pilot-house and smoke-stack are not circular tube-shaped, but are flattened on the sides, and sharp fore and aft, on the same principle as the bow and stern of the ship.

"People may object to being sealed up in your cylinder-shaped vessel during an entire voyage to Europe," the visitor remarked. "In case of an accident there would be no opportunity to escape."

"A great many people object to going to Europe on account of the danger they are exposed to on board the present vessels," said the in-

ventor. "Could they be convinced that there was no danger in making a voyage to Europe, there would be many more who would make the trip. On my vessel there would be no danger whatever; as I said, it is impossible to sink her. The only accident that could happen would be a break-down in the machinery. But each ship would carry duplicate machinery, so that an accident could be repaired immediately. Then, my ship would be fitted up as comfortably as a hotel. There will be heavy plate-glass windows running along the sides of the ship, and the ventilation will be perfect. I intend having a railing along the upper part of the vessel, so that in pleasant weather the passengers may take a promenade, if they wish. In bad weather they don't want to be outside. In a heavy storm, when the sea is pitching over a vessel, —seas that would wrench and disable an ordinary ship,—my boat will ride it as safely as though she was steaming up the East River. The passengers will feel as safe as though they were sitting in their own parlors. The water, when rushing over the deck of an ordinary ship, carrying away the bulwarks and rigging, will run off my vessel like the water off a whale's back. The boat is so modeled that if she should turn over,—which will be impossible, as the centre of gravity will be below the water-line,—but if she should turn over, she would float as well one way as the other. All that the passengers would have to do would be to stand on their heads. To be sure, that might inconvenience them some, but then there is no danger. There is a picture that will illustrate how she will weather a storm," and the inventor, artist, and engraver pointed to a picture hanging on the wall.

The painting is of his patent safety steamship in a terrible storm, executed by the inventor himself. The hurricane is blowing due east, and heavy black clouds hover about in close proximity to the smoke-stack. The sea is running "mountain high" and breaking over the ship from a represented height of forty feet. Part of the ship is obscured, from her being submerged amidships. The bow is about plunging into a great sea, while the stern projects from another. Away up in the pilot-house the captain is seen with his face glued to the glass, his hands firmly grasping the wheel, the sea breaking about him in a white, foamy mass. In through the plate-glass windows the passengers are forming a set for a quadrille, as unconcerned as though they were sailing up the Hudson on an excursion barge.

"Here is another," said the inventor, shortly afterwards, pointing to a picture on the other wall, "which presents the ship in another light."

The painting represented the ship in smoother water, under sunshine, evidently steaming along at a rapid pace. A little astern is a sea-gull. The reporter interpreted it as a race between the patent safety steamship and the gull, in which the bird is beaten.

"What will be the dimensions of your ship?" the reporter inquired.

"My figures," replied the inventor, "are 360 feet in length, 25 feet beam, and 35 feet deep. She can be built larger, if necessary.[5]

1882.—CAPTAIN LUNDBORG'S TWIN-SCREW STEAMSHIP.—His design, which he has patented in the United States and Europe, is based on a novel form of vessel, which renders high speed possible, while adding greatly to the carrying capacity and stability of the vessel.

The design, while affording ample space for passengers and valuable cargo, has the primary object of attaining a velocity of twenty to twenty-one knots an hour, with a comparatively moderate expenditure of power. The prominent idea is that of making the main body of the ship divide the water horizontally instead of vertically. By adopting this system of construction he says, it becomes possible to build a ship of the greatest capacity for a given draught,—an advantage which speaks for itself. But, besides this, it is stated that this ship of shallow draught and great capacity can have admirable lines, and her resistance may be reduced to a minimum. The principle, he claims, admits of the naval architect imparting to his ship a splendid clean run aft, and the screws can be carried far astern and yet be well supported. The advantages to be derived from thus placing the screws far astern have been insisted on by the late Mr. Froude. No scheme has been put forward which is so perfectly adapted to the use of twin-screws. If desired, the stern of the ship can be carried farther aft, to protect the screws. There is ample room provided for engine-power, notwithstanding the fine run of the hull aft. The principal dimensions, etc., of Captain Lundborg's proposed ship are:

Length of hull below water on the plane of greatest beam	450 feet.
Greatest breadth	66 "
Length on load water-line	444 "
Breadth on load water-line	58 "
Draught of water on load water-line	23 "
Length over all on upper deck	475 "
Breadth on upper deck at greatest transverse section (outside of frames)	62 "
Depth from top of upper deck beams to bottom plating	41 "
Height between the upper and second decks	9 "
Height between second and third decks	9 "
Height between third and orlop decks	8 "
Area of greatest immersed transverse section	1,412 square "
Coefficient of greatest immersed transverse section	0.09303
Area of load water-plane	15,255 square feet.
Displacement to load water-line	380,836 cubic "
Displacement	10,881 tons.
Horizontal distance of centre of buoyancy from the submerged stern	225 feet.
Vertical distance of centre of buoyancy below load water-line	11,456 "
Height of metacentre above centre of buoyancy	7,469 "
Height of metacentre above centre of gravity of the ship when fully equipped and loaded	3,458 "

[5] *Brooklyn Eagle*, July 17, 1882.

Height of metacentre above centre of gravity of the ship at 14 feet draught of water, with no cargo, coal, stores, water, or ballast, and no water in boilers, but otherwise completely fitted and fully rigged	5,060 feet.
Height of metacentre above centre of gravity of the ship at 9.6 feet draught of water, the hull being complete, with masts in and rigged, but empty, without engines or boilers	11,389 "
Wet surface when immersed to load water-line	38,040 "
Angle of obliquity of load water-line at the bow	5° 50′
Angle of obliquity at the stern	6° 30′
Mean angle of obliquity at entrance	7°

The ship is to have two propellers of 16 feet diameter and 28 feet pitch; the propelling power to consist of *four* compound engines, two on each propeller shaft, developing each, when making 90 revolutions per minute, 4500 indicated horse-power, or for all four engines together, 18,000 indicated horse-power. With this power the speed, according to Professor Rankine's formula, would be 20.7 knots per hour; but that speed would in all probability be exceeded, as little power will be lost by wave-making, the water having a clean run astern, being divided horizontally by the lower part of the hull.

The ship would have room to accommodate about 600 first-class and 1000 second- and third-class passengers, and carry 3000 tons of cargo, 23 feet draught of water, besides 2700 tons of coal.

The ship is designed to be built of iron or steel, with a double bottom, and with a great number of water-tight compartments, transverse and longitudinal.

The peculiar form of the hull makes it possible to unite great carrying capacity with the finest lines for high speeds. The submerged stern, which divides the water horizontally, admits of the finest possible run aft, and affords a perfect support and protection to the propeller shafts. With this construction the propellers act constantly in solid water, unaffected by stern-post, rudder, and the overhanging part of the stern, as in ships of the usual form. This feature secures an economy of power, or, what is the same thing, an increase of speed.

A vessel of this form will not roll and pitch as much as other vessels, as the body of water above the projecting part of the hull offers considerable resistance to such motions.

The rudders may be nearly balanced, and will require but little power to work them, and, on account of the peculiar form of the stern, the rudders may have considerably less area than those of the common model, as it requires less power to move the stern laterally.

The form of the hull, while permitting very sharp entrance and run, affords ample room for the application of the greatest engine-power compatible with carrying capacity.[6]

[6] The *Scientific American*, October 21, 1882, has a view of the ship complete, and also of her stern. She is represented as having three funnels and four masts, three of which are square rigged.

1882.—ROOT'S SIDE-SCREW STEAMSHIP.—A vessel of this kind is being built at Greenpoint, Long Island, by Samuel Pine, for Señor Diaz, for lighterage service in Cuba. This vessel embodies in the arrangement of her propelling wheels the ideas set forth by Mr. Root before the American Society of Mechanical Engineers. The hull is one hundred feet long, thirty-two wide, and with one hundred tons of cargo draws only three feet of water. She is decked over and has a flat bottom, with vertical sides, longitudinal strength being obtained by three fore and aft bulkheads, and she is the first example of what is thought by experts will be a revolution in the science of screw propulsion.

A high rate of speed is not expected, but her performance will exemplify the economy which Mr. Root claims for his novel application of screw-propelling wheels. These wheels are set on the ends of an athwartship shaft, the plane of their faces being fore and aft, and not as the common type of screw propeller is, at right angles to the line of motion of the vessel. They are driven by a vertical direct-acting engine. The boiler is a vertical tubular, which will drive the wheels from one hundred and fifty to two hundred revolutions per minute. The "true-screw" type of wheel is used, six feet in diameter.

In his experimental workshop Mr. Root has a trough of water, in which he exhibits the speed of different models moved by clock-spring machinery, turning various types of propelling wheels. It is interesting and instructive to see one model in particular spinning down the trough, propelled by a screw-wheel revolving horizontally under the bottom, the propelling force being generated by a current of water sucked in by the revolutions of the screw, between it and the incline of the bottom of the boat. There seems no limit to the power that could be exerted by this oblique-acting current, excepting in the size and speed of the screw-wheel, and the illustration of Mr. Root's theory by the action of this model is conclusive as to its theoretical correctness. It presented an amusing and instructive paradox in the propelling effect produced by a vertical screw-shaft, its thrust being at right angles to the line of motion,—the propeller blades working horizontally and parallel with the keel instead of at right angles to it, as all propellers do that are now used. "In the present method of applying the screw-propeller wheel," says Mr. Root, "the maximum propelling effect has without doubt been obtained, for it is well known that an increase of engine-power gives nothing like a proportionate effect in speed. Sixty per cent. of all the power is wasted somewhere, Mr. Froude calculates, and accounts for this great loss of power in the present method of stern screw-wheel propulsion in the fact that a screw-wheel at the stern of a vessel draws the water away from the after body, creates a suction, as it were, and, of course, increases thereby the head resistance, such increase varying with the size of the column of water acted upon by the wheel.

"It is a fact in practice that all craft propelled by a stern screw-wheel, when they reach a certain velocity, settle down by the stern; and, pile on the power as you may, beyond that point no more speed can be obtained. They can and do settle, however, which fact shows clearly that a vacuum is formed when a high rate of speed is obtained, and that the screw-wheel, operating in the vacuum, becomes, more or less, a retarding instead of a propelling force, as such 'minus-pressure' adds directly to the head resistance. It has lately been found in England that at high speeds the power does not follow the speed produced in a uniform ratio, as in some speeds it may vary as the cube; beyond them it drops down as low as the square of the velocity. Fluid action around a vessel is something of an enigma, and the columns of water acted upon by a screw-wheel at the stern, in its reactionary thrust, is more so. The fact of the enormous waste of power in the best examples of steam screw-wheel propulsion is incontrovertible."

Mr. Root proposes to change the position of the wheel, and make the currents generated by their revolutions force the vessel through the water by their oblique action on the sides of the after-body or "run" of the vessel. His system has been patented in the United States and abroad, and is analogous in its application to the action of fishes when swimming, the power being applied laterally. At a point in the "run" of his craft where the water begins to close in laterally he places his wheels. The shaft is at right angles to the keel, and the wheels some sixteen feet apart. The proper pitch, etc., of these wheels has to be determined by experiment, but they will drive a current inboard along the sides of the run (which will be made concave, vertically) that, in its impinging force upon the converging sides of the hull, will propel it forward. It is like the snapping of a bean between your fingers, and the larger the wheels and the greater their velocity the more power they will exert, as they work always in solid water.

1882.—Coppin's Triple Steamship.—Captain William Coppin is an old and well-known constructor and inventor. As early as 1842 he built the "Londonderry," a screw steamship of 1500 tons, the largest screw steamer that had up to that time been built.[7] She was sometimes called the "Great Northern," and antedated the "Great Britain," which was laid down as a paddle-wheel, but before launching altered to a screw. Captain Coppin's United States patent is dated March 28, 1882, and his idea, which has yet to be put to a practical test, has been approved and indorsed by several distinguished officers, both line and staff, of the United States navy, and William Pearce, of the well-known firm of William Elder & Co., who, under date of September 11, 1880, says, "I am satisfied that twenty knots an hour will be very readily attained with this (your) form of vessel, and of the power, displacement, and dimensions contained in your estimates."

[7] See vol. xii., page 271.

The invention consists of a compound ship, consisting of three ship hulls united as one vessel, the two outer hulls being of equal length and longer than the central hull, and the whole being decked over. The three hulls are rigidly connected by iron or steel bulkheads, box-girders, and iron or steel decks, or frames, so as to form complete platforms or decks, and leave considerable extra space between the ships. The centre ship is to carry the engines, and is provided with a propeller at each end. This arrangement brings the screws well towards the centre of the outside hulls and prevents a possibility of the pitching motion lifting the propeller out of the water. The three hulls are tapered from the centre, both longitudinally and vertically, and come to a rounded point at both ends, so as to enter the wave and reduce the pitching motion to a minimum, the rolling being done away with by the extent of the water-space between the ships. The decks extend in the centre three-fifths (more or less) of the length of the outside ship. The remaining portion of the ends are covered over for passing through the waves. For smooth-water ferry-boats and the like, the decks are proposed to be the entire length of the outside hulls.

Captain Coppin claims that his improvements are "specially applicable to war-ships, and enable a large amount of armor-plating to be carried, and give an extended battery platform to carry guns of the largest calibre, and that turrets of increased thickness of armor-plate can be employed with safety. Complete protection is also given to the engines, screw-propellers, and steering apparatus, increased accommodation for a large number of troops and horses, with a speed at least one-third faster than the present class of transports; and the construction is such that one of the three ships might be completely riddled with shot or damaged by a ram, and yet be supported by the other two." There can be no question that a vessel of this description will have great stability, and can be armor-clad, and that the outer hulls will have to be penetrated before the central hull, containing the engine, can be reached, and that the broad platform of her deck would be admirably adapted for carrying guns of heavy calibre. As a ferry-boat she seems also to unite many advantages, and her broad decks and stability seem to adapt her particularly for a railroad ferry barge. Her ability to turn rapidly in a seaway and to withstand Atlantic gales, and also the speed she might attain, has yet to be put to a practical test.

1882.—THE FRYER BUOYANT PROPELLER "ALICE"—A VELOCIPEDE OR LOCOMOTIVE.—A working model of this queer craft stands in a brick-yard at Hastings-on-the-Hudson, where it is an object of great curiosity. The model consists of a triangular frame-work resting on three wheels, which are in the same relation to each other as the wheels of a tricycle. These wheels are spheroidal in shape, about six feet in diameter, and are housed above with dome-shaped covers. Each sphere is a propeller, having flanges or buckets at the sides at right

angles to the vertical diameter, and acting upon the water like a paddle-wheel. These spheroids are driven by steam. At the same time they serve as floats, and are submerged about one-sixth of their capacity. Another feature of the propellers is that they have an iron tire or keel, by means of which they may be made to serve as wheels, and carry the vessel along a track on dry land. An engine rests on the frame-work between the two propellers that are opposite each other. The frame-work forming the deck is supported on the axes of the wheels, so that it is several feet above the surface of the water.

Robert Fryer, the inventor, conceived the idea of his water-car about twelve years ago, and has been engaged in making experiments ever since. His first model was made on a small scale. It consisted of three hollow copper globes connected by axles to a frame superstructure, and of the same form as the larger model. The spheres were twelve inches in diameter, made to revolve by springs placed inside and wound up by keys. After repeated experiments in a tank, it was rigged with a small sail and launched on the Harlem River, with good results. Daily experiments were subsequently made with the steam model on the Harlem, much to the astonishment of those who saw it. It was found that it could be turned in its own length; that there was no appreciable slipping, and that it was little affected by the action of the wind or tide. When the "Alice" was taken to Hastings it made part of the distance on dry land, steaming along the road like a great lumbering wagon.

The plan proposes a huge hollow semi-cylinder for the superstructure, containing saloons and state-rooms, with masts and rigging above for carrying sails. One claim made for the buoyant propeller is that it cannot be overturned in the roughest sea, on account of its triangular shape, and that its oscillation in a violent sea will be less than that of an ordinary vessel on comparatively smooth water. The advantage from this is that passengers would have no fear of sea-sickness. The inventor believes that his ship will excel the steam-vessels now in use in point of convenience and comfort, and be a safer means of transit, as the ship proper would stand thirty feet above the water, and out of reach of the waves even in a stormy sea. He also designs to apply the same principle to the construction of dispatch- and life-boats. If this water-car comes up to the expectations of its inventor, it will make the passage of the Atlantic between Sundays.[8]

[8] Two correspondents of the Manchester *Times*, in October, 1882, referring to Fryer's Marine Velocipede, say,—

"In June, 1866, a patent was granted in America to A. Blomquist and C. Cooke (patent No. 56,351) for a 'marine car' on three spheres, with paddles attached, on the same principle as that described by your correspondent 'Mechanic.' What made me notice his account is the fact that about five years ago I made a model of the vessel for Mr. Blomquist, of Brooklyn, New York, one of the original patentees.

"ANOTHER MECHANIC,
"Late of Brooklyn, New York."

1882.—Rosse's Catamaran Steam-Tug.—This novel steam-vessel, which was built at Brown's ship-yard, in Tarrytown, is now in the harbor of New York, waiting trial. Its inventor, Captain J. Rosse, will claim the reward offered by the government for a steamboat that can run in canals without washing or otherwise injuring the banks. The practical utility of the craft has not yet been proved, but it is believed that it will prove very powerful in towing canal-boats without making a destructive washing against the bank. The boat is built of two very narrow hulls, fifty-three feet in length, with the machinery and weight thoroughly balanced on them. She lies low, so as to pass under the canal bridges. A huge belt, which runs fore and aft over two drums at right angles with and between the two hulls, has buckets or paddles fixed across its outer surface. The power is applied to the drums, and the belt is moved around from forward to aft, taking the water easily, and leaving it without making a commotion. The novelty has so far made satisfactory speed.[9]

1882.—A Boat Propelled by Electricity.—The *Scientific American* for November 11, 1882, has a description and an engraving of a small boat propelled by electricity, lately tried on the Thames River near London. It also gives transverse and longitudinal sections and a deck-plan of the boat. The hull is of iron, 25 feet long, 5 feet beam, drawing 21 inches of water forward and 30 inches aft. She is a screw boat, the propeller being of the Collis-Browne type, 20 inches in diameter, and with a 3-foot pitch. The screw is calculated to make 350 revolutions per minute. Twelve persons can be accommodated on board, though only four were actually carried on the trial trip. The electric engines are nothing else than a pair of Siemens's dynamos, of the size known as D3, and their motive power is furnished by Sellon-Volckmar accumulators. These accumulators are a modification of those of Plante and of Faure, but are made of specially compact design for the purpose of electric navigation. The cells each contain forty prepared plates,

"'Mechanic,' Carlisle, describing the vessel invented by Robert Fryer, of New York, would almost make us believe there *is* something new under the sun. But though the remarkable vessel may be new, the idea is not. I once inquired of the editor respecting a machine on which a man walked on the river Tyne, and was told that my question was not sufficiently explicit. The machine described by 'Mechanic' corresponds exactly with the invention to which my question referred. If I recollect rightly, the machine I saw was a marine velocipede, on three long, spider-like legs, stretching from what formed a seat for the rider. These legs were fixed in hollow tin spheres, sufficiently large to bear his weight, and wide enough apart to enable him to maintain his balance. The rider had flanges or flappers fitted on his feet, and was thus enabled to propel himself. Although the speed was not very great, it was sufficient to enable him to keep pace with the boats around him,—namely, the procession of barges on the day when George IV. was crowned.

"Driffield, South Shields."

[9] Engravings of this catamaran, the Fryer propeller, and the domed steamship "Meteor" can be found in *Harper's Weekly*, October 7, 1882.

and weigh about forty pounds. They are about ten inches square and eight inches high, and are charged, while the boat is lying at anchor, by wires which come across the wharf from the factory, bringing currents generated by dynamos fixed in the works. There is room for a battery of fifty-four such cells to be stowed away, as will be seen upon the drawings, where the battery cells are marked B B. Only forty-five cells were used at the trial trip. They had a total electromotive force of ninety-six volts, and were capable of furnishing continuously for nine hours a current exceeding thirty ampères.

When in action the counter-electromotive force of the motors reduces the apparent strength of the current according to Jacobi's well-known theory of electro-magnetic engines. The accumulators have a total weight of somewhat less than a ton. The motors of electric engines are arranged so that either or both of them may be furnished with the current, there being a switch to each lead. There is also a commutator to switch into circuit any number of cells from forty upward. One of the motors can be thrown in or out of gear by means of an Addyman's friction clutch, which permits the pulley to be started and stopped with great facility without shocks. A reversing gear for the two motors is contrived by the very simple device of arranging two pairs of brushes for each collector or commutator, one pair having an angular lead forward, the other a lead backward. By a simple lever arrangement either pair of brushes can be pressed at will against the segments of the commutator. In practice this arrangement works well, the boat being very readily stopped by reversing the engines in this fashion. As will be seen from the drawings, the motors are connected by belts to pulleys on a countershaft, from which a belt passes down to a pulley on the propeller axis, whose speed is thus reduced in the proportion of 950 to 350 revolutions per minute. The steering is managed by the same person who operates the switches, seated in the central cabin. A whistle being impossible in the absence of steam, this necessary feature is replaced by a large electric bell, also worked by the accumulators. The calculated average speed is nine miles per hour. This speed, says *Engineering*, was actually attained on the trial trip from Milwall to London Bridge and back.

1882.—A Steamship Brake.—The stopping of steamers suddenly, when under way, has long been a problem unsolved. But a near approach to an effective "brake," as it is called, is in operation on one of the small craft plying between City Point and Long Island, in Boston harbor. A trial of the device, invented by Mr. John McAdams, on the steamer "City Point," was made in the harbor in November. The arrangement is simple, and is seen at once from a glance at the working model. The essential parts are two large metal fins on the after part of the hull, one on either side, which can by a simple movement be thrown at right angles to the body of the boat,

presenting a broad surface to the water and effectually checking the boat's headway. The fins can be made of any size, those of the "City Point" being five feet by four. The fins are hinged securely on the stern post, and are sustained when open by three strong telescope braces and a chain, the last-named also serving to close the apparatus. When closed the appearance is of two closed port-holes. The material is steel. A strong spring opens the fins, just starting them a few inches, and the force of the water throws them open to the full extent. There are two levers for working the apparatus, one in the pilot-house and one on the forward deck. An additional and automatic arrangement has also been invented, consisting of a long lever to hang from the end of the bowsprit of large vessels, and serving to work the apparatus automatically in case of sudden collision. In case of necessity one fin can be worked alone, not only checking the speed, but also turning sharply aside. The "City Point" got under way, and, while at full speed, the signal was given and the fins thrown back. The motion of the boat was checked with a sharp shock, and before ten feet of space were covered she lay perfectly still. The effect of forty square feet of steel braced suddenly at right angles to the vessel may be imagined. Several trials were made, both with steam on and with steam shut off at the moment the fins were opened, and in both cases the motion was quickly stopped. The patent has only been issued a few weeks, and nothing has been done looking to the general introduction of the brake, but its succees on trial certainly shows that steps have been taken in the right direction towards preventing the numerous collisions of steamers and the consequent loss of life and property.

OCEAN MERCANTILE STEAMERS.—The net tonnage of the maritime nations of the world, according to the French Bureau Reports in 1882, was,—

Countries.	Net tonnage.
Great Britain	3,133,453
United States	408,496
Norway	53,340
Germany	234,680
Italy	75,646
France	302,432
Russia	87,997
Sweden	66,204
Spain	144,691
Holland	81,048
Greece	11,019
Austria	66,352

1882.—There are sixty-five steamers in the British merchant marine of considerable coal-bearing power that possess an ocean speed of upward of thirteen knots, and the P. & O. Line possess forty-eight steamers with a speed of over twelve knots.

1882.—THE LIMIT OF STEAM PRESSURE.—In the time of Watt the ordinary limit was seven pounds. Ten times this pressure is usual now, while ninety pounds is not uncommon. The rise within the past ten years has been twenty-five pounds, and with the constant study of boiler structure and boiler capacity for work and strain, we may expect to see at least an equal rise during the coming ten years. Pressures of one hundred pounds and over are occasional now, but are yet far from being the rule. The increasing use of steel in boiler construction must lead to developments that will help the solvement of the problem.

1882.—A NOVEL APPLICATION OF THE SCREW.—The screw propeller at the stern has maintained its position unchanged, though often varied in its form and in the pitch, or number of its blades, since it was first brought into general use. It has been tried at the bow, where it worked well enough, until it proved troublesome when brought in contact with drift-wood. It has been placed at the sides, where it operated only as an imperfect paddle-wheel. Recently it has been tried in an entirely new position. The vessel to which this new method of placing the screw has been applied is a lighter, designed for carrying heavy freight upon a crooked and shallow river. Her wood hull is about ninety feet long and thirty-two feet wide, and draws about thirty-nine inches when loaded with one hundred tons of freight. In general appearance the boat does not differ from the ordinary steam-lighters used in American waters. Her hull is of the usual shape, except at the stern; there the after-body turns abruptly inward at the water-line, making a double curve towards the stern-post. Below the water-line the hull carries a lip or projection that follows the ordinary lines of a ship's stern. In the concave recess on *each side of the stern* is placed a single screw, facing outward,—that is, the shaft carrying a screw at each end extends directly *across the hull.* This shaft is just at the water-line, and carries each screw half-submerged. The deck above each screw overhangs the hull, as in American river-boats. The engine is placed between the two screws and directly connected with the shaft. On turning the two screws placed in this position, it would appear that they would act as paddle-wheels. They do so, but the amount of work performed in moving the boat is thought to be very small. Experiments seem to prove that the movement of the boat is caused by the streams of water turned by the screws against the wedge-shaped hull. The water thrown into the concave part of the stern cannot easily escape, and the result is the hull is thrust forward by the action of the water against it. The actual trials of the boat show that she can be moved with a full load, in rather rough water, at a speed of from *four to five knots* an hour. This is considered good speed for such a boat, with her small engine-power. On the second trial trip careful measurements were made of the power utilized by the screws.

The boat was towed at her usual speed, and the amount of strain on the tow-line found by the aid of a dynamometer. The power needed to move the boat, compared with the actual working power of the engine, was found to be over fifty per cent. In other words, one-half the actual power of the engine seems to be realized in moving the boat. This is considered a favorable showing for the position of the screws. The trial trips of the new boat are regarded as interesting contributions to the question of screw propulsion. The positions of the screws give a good economy for the power employed, and in new and faster boats, that are to be built upon the same pattern, more interesting results may be expected.[10]

1882.—THE DOME STEAM-YACHT "METEOR."—There is now building at Nyack-on-the-Hudson a steamboat of naval construction which is rapidly approaching completion. This craft is the design, model, and invention, both in hull and machinery, of Captain A. Perry Bliven. She will be launched on the 1st of August. Her dimensions are: Length over all, 153 feet; water-line, 136 feet; on keel, 128 feet; extreme beam, 21 feet 6 inches; beam at water-line, 17 feet; extreme depth of hold, 17 feet; draught forward, 6 feet; draught aft, 11 feet; tonnage, old measurement, $512\frac{30}{100}$. This vessel is an entirely new departure from the principles and designs of the steamers now afloat, and is the pioneer vessel of the American Quick Transit Company of Boston. The "Meteor" will be followed by large steel steamers of the same model, and with the most powerful machinery ever yet placed in ocean steamships. The "Herald," to be built in Boston, on the "Meteor's" model, will be of the following dimensions: 425 feet long; 56 feet beam; 48 feet hold; draught forward, 17 feet; draught aft, 26 feet; capacity, 7500 tons, old measurement. She will have four steel boilers, new pattern; three double compounded steel engines, twelve cylinders; actual horse-power, 18,000; capable of making a speed of 28 to 30 miles per hour.

It appears that the inventor's aim is to make a self-righting boat by carrying the sides over the deck in the form of a dome. The side frames are made continuous, and meet over the centre of the hull, or, in other words, the frames begin at one side of the keel, rise directly at an angle of about forty-five degrees to the water-line, and then curve inward over the deck and back on the same lines to the keel. A section of the hull taken in the centre is thus of a wedge shape, with a sharp edge below and rounded top above. This wedge-form is preserved through the entire length of the hull. There are no hollow lines in the boat, and the sharp, overhanging bow is intended to part the water near the surface, and to form a long, tapering wedge. The widest part of the hull is exactly at the middle, both ends being precisely alike. This is quite different from the flat bottom and straight

[10] *The Century* for November, 1882.

sides, with comparatively bluff or rounded bows, of the ordinary ocean steamship.

The boat is intended to be much deeper aft than forward, and the deck will be much higher above water at the bows than at the stern. There will be no houses or raised constructions of any kind on deck, except the dome-shaped pilot-house, the ventilators, and the smoke-stacks. There will be an open railing around the centre of the deck, so that it can be used as a promenade in pleasant weather, or whenever the seas do not break over the boat. The object of this unbroken dome-shaped deck is to enable the boat to throw off all waves that break over the bows or sides in rough weather. It is thought that, instead of shipping tons of water and retaining it on deck till it can be drained off, the boat will shed or throw off the water from the long, sharp bows and open deck, and will at once relieve herself of the weight of the water. Waves striking the rounded deck will have no hold on the boat, and their force will thus be spent harmlessly. The sharp wedge-shape and rounded top of the hull, and the fact that even when fully loaded the centre of gravity will be below the water-line, makes the model self-righting.

From experiments with a small model, this claim of the inventor seems to be clearly proved. In laying out the boat only the spar-deck will be used for passengers, the main-deck and all below being intended for cargo, coal, and engines. The state-rooms will be arranged along the outside, each room having a port in the side of the boat, while the ceiling will be formed of the curved deck above. The saloons will be the whole width of the ship, and on the spar-deck. For lighting the saloons there will be skylights in the centre, and as these in rough weather may be covered by the seas that sweep over the deck, they will be very strong, and will be air-tight. To secure ventilation there will be steam-fans, kept in motion at all times, and maintaining a good circulation of air through every part of the boat. For this purpose the fresh air will be taken through wind-sails on the deck, and the exhaust air from the rooms will be turned into the blast used in forcing the boiler fires. No boats are to be carried on deck; the life-rafts and boats will be kept in an apartment under the domed deck at the stern, and when they are to be launched doors will be opened in the deck, and the boats launched in the usual way from davits through these doors. The pilot-house will be at the bows, and will be entirely inclosed. It will not rise much above the deck, and will be entered from below.

There will be no masts or sails, as it is intended to depend wholly on the engines for propulsion. In constructing the hull, to secure great strength, three heavy trusses, or "hog frames," are to be placed on the keel, each one rising to the spar-deck, and securely fastened to the side frames of the boat. The ceiling will be double, and placed diagonally

on the frames. In the larger steamships the absence of sailing power will be compensated for by two extra engines and two supplementary screws, that can be employed in case the larger screw is lost, or the main engines break down.

1882.—HERR BECK'S GUNPOWDER ENGINE.—A patent has been taken out in Germany for a gunpowder engine. Years ago, before Savery and Newcomen introduced their rude attempts at steam-engines, Huyghens and others, notably Papin, endeavored to utilize the force of exploding gunpowder as a means of obtaining motive-power, and engines were constructed which demonstrated at least the *possibility* of the idea. A tall cylinder, having a touch-hole at the bottom, was fitted with a heavy piston, to which ropes were attached passing over pulleys. A sufficient quantity of gunpowder was placed inside the cylinder to drive the piston nearly to the top when the powder was fired, and then the gases escaping through the touch-hole, and being also condensed, the atmospheric pressure forced the piston down, and men who were holding on to the ropes were hauled up. Of late the idea has been utilized in the construction of a pile-driver, the "monkey" being driven down by the force of exploding gunpowder. Herr Beck has recently devised an engine the piston of which is driven backward and forward by small charges of gunpowder supplied at each end by an automatic arrangement. The ignition is effected by the motion of the piston, which draws in a flame of gas or spirit, the access being regulated by slide valves, which also opens outlets for the escape of the gases of combustion.

1882.—A NEW MOTOR.—A new motor has been discovered, which, it is claimed, will supersede steam. The material from which the energy is generated is bisulphide of carbon, which is utilized as a motor agent in the form of vapor, and the advantage claimed for it over steam is that, while water expands in the ratio of 1 cubic inch to 1700, bisulphide of carbon has an expansive property of 1 to 8000. When the vapor is generated it passes into the steam-chest of the engine and moves the piston-rods. A pipe attached to the engine conveys the exhaust vapor directly through a condenser back to the tank in its original liquefied form, to be regenerated. The system of generation and condensation is similar to the heart-action; and with machinery perfectly constructed it is claimed that a single supply of the bisulphide of carbon can be used with reinforcement for an indefinite period. The cost of fuel is trifling, it being claimed that from the peculiar properties of the bisulphide an ordinary house fire can develop a power sufficient to run an ocean steamer. Water boils at 212°, and it takes 320° of heat to make steam available, while the new agent takes the form of vapor at 180°. The invention is owned by J. R. Blumenburg, a German, who has been exhibiting it to Philadelphia capitalists with such success that they are likely to try it on a large scale.

CHAPTER VI.

THE GREAT OCEAN STEAMSHIP COMPANIES.—GENERAL REMARKS, OCEAN TRAMPS, ETC.—The Cunard, 1840.—The Peninsular and Oriental, 1840.—Pacific Steam Navigation, 1840.—Royal West India Mail, 1841.—Collins Line, 1847.—Pacific Mail Steamship Company, 1848.—Warren Line, 1850.—Inman Line, 1850.—The Messageries Maritimes, 1851.—Allan Line, 1854.—Hamburg American Packet Company, 1855.—Anchor Line, 1856.—North German Lloyds, 1857.—Leyland Line, 1860.—Compagnie Générale Transatlantique, 1862.—National Steamship Company, 1863.—Williams & Guion Line, 1866.—Old Dominion Line, 1867.—White Star Line, 1870.—American or Keystone Line, 1871.—City Line.—State Line, 1872.—Red Star Line, 1873.—The Monarch Line, 1874.—Harrison Line.—Ocean Steamship Company of Savannah.—The Mitsu-Bishi Steam Navigation Company, 1875.—The Atlas Steamship Company.—Roach's United States and Brazil Steamship Line, 1875.—The Mallory Line.—The Red "D" Line, 1879.—New York, Havana, and Mexican Mail Line.—Boston and Savannah Steamship Company, 1882.—Thingvalla Line, 1882.—West India Steamship Enterprise.

I AM indebted to the courtesy of the managers, agents, and owners of the several ocean steamship lines for the major part of the information contained in this chapter, but I have also drawn from printed histories and circulars and communications which I have found in magazines and newspapers since these sketches of ocean steamship lines were written, and in part printed in the UNITED SERVICE.

The *Century*, in its September number, has published an interesting article on ocean steamships, by S. W. G. Benjamin, which has been supplemented by an anonymous communication entitled "More about Ocean Steamships," published in the Boston *Transcript*. The writer seemed to be well posted up in his subject, better even than Mr. Benjamin, and as his communication contains some interesting facts which I have not given, I take the liberty to quote from him a few paragraphs to supply the deficiency.

"The steamships of the world," he says, "may be roughly divided into three classes. These are, first, those belonging to mail lines, carrying passengers and mails, and leaving and arriving at certain ports at an advertised time, and with the greatest regularity possible under the circumstances. The second class consists of steamers not carrying the mails, and sometimes but a few passengers, chiefly devoted to the carrying trade,—cattle, grain, miscellaneous cargoes of ore and general products,—but plying with a certain regularity between stated ports. The third class comprises all steamers which, having no fixed route, go to any port which offers the best terms for freight, wandering around the globe, and hardly touching at the same place twice. These latter are the 'ocean tramp' class of steamships, on which in many cases opprobrium has been unjustly heaped."

Of the first class of steamers, the two largest lines in the world are the British India Steam Navigation Company and the Austro-Hungarian Lloyds. It is hard to say exactly which is the larger, but at present the steamers owned by each number about seventy-seven and seventy-nine respectively. The British India Company does its chief business, as its name indicates, with India and its dependencies, and the map which represents its different routes is a net-work of bewildering lines. Every port in India is in communication with Calcutta, Bombay, and Madras by this company's steamships, and communication with London is kept up by fortnightly steamers. This company runs steamers every fortnight also from London to the Persian Gulf and Bagdad, calling at Algiers; and it has lately started a line to Brisbane in Queensland *via* Batavia. Its steamers have until lately been of medium size, but it is now building larger ships. Its vessels are named after Indian towns, etc., and the names are mostly very pretty, as "Merkara," "Dorunda," "Ellora," and others.

"The chief lines from London to the Cape direct are the Union Steamship Company (thirteen steamers), and Donald Currie & Co.'s Castle line (twenty steamers), mostly large and fine ships, while the trading stations on the West Coast of Africa are supplied by the African Steamship Company, and the British and African Steam Navigation Company, with smaller steamers, more or less devoted to freight, although carrying the mails.

"Lamport & Holt also run a line from London to Brazil and the river Platte, some of the steamers returning to Liverpool *via* New York. This line has some thirty steamers of moderate size, named after scientific men, painters, and poets.

"The City Line (City of London, of Venice, of Khios, etc.) is owned by George Smith & Sons, of Glasgow, who also own a large fleet of sailing ships. There are ten steamers in this line, all fine ships of 3000 tons. The Hall Line (Werneth Hall [4100], Breton Hall, etc.), owned by the Sun Shipping Company, and the Star Line ("Vega," "Orion," etc.) are favorite lines for India, as is also the Ducal Line (Duke of Lancaster, etc.), which has some very fine ships, seven in all. These last-named lines all come more or less under the second heading of combined passenger and freight steamers.

"Hamburg sends out lines to Panama (Hamburg-American Steamship Company), to Brazil (Hamburg-South American Steamship Company), to Valparaiso (Kosmos Steamship Company). It is not generally known, however, that the French Transatlantic Company by no means confines its operations in America to its New York business, but has some fine steamers running to Aspinwall, Vera Cruz, and the West Indies.

"Turning to the Pacific Ocean, we find only one English line connecting America with Asia,—the Oriental and Occidental Steamship

Company, which is really a part of the White Star Line. The fine steamers "Arabic" and "Coptic," of 4300 tons each, which were built last year, and ran a short time on the Atlantic, have now their place in the O. and O. Company's fleet.

"Turning, then, to the second class of steamers, the organized lines of 'freighters,' we find in this category many lines of fine ships, so many, in fact, it will be impossible to mention more than a few. At the head of this class stands the firm of Thomas Wilson, Sons & Co., of Hull. They own fifty ships, averaging fully one thousand five hundred tons each, their names all ending in 'o.' Besides the lines of steamers running from Hull to Boston and New York,—only a tithe of their immense business,—Wilson & Co. dispatch ships to all ports of the Baltic, to Germany, Holland, and France, and even to Constantinople. Their business is rapidly increasing, and they have built within a few years a number of large ships, chiefly for their Atlantic trade.

"McGregor, Gow & Co., of Glasgow, own the Glen Line of steamers (not to be confounded with another line of Glen steamers owned by Lindsay, Gracie & Co., of Leith), fifteen in all, employed in the China and Japan trade, noted as tea-ships. They are of moderate size, and of a good model. The 'Stirling Castle,' of 4423 tons, which has earned the name of being the fastest steamer in the world, belongs to another 'tea' line of nine steamers, owned by Thomas Skinner, of Glasgow, named after Scottish castles. Another China line is the Ocean Steamship Company, owned by Alfred Holt, Liverpool, twenty-four steamers of about 2000 tons, named from Homeric characters. Warren & Co., of Liverpool, although they own only three steamers (the ships not named after States being, according to the registers, chartered), have in those three, the 'Missouri' (5146), the 'Kansas' (5276), and the 'Iowa' (4329), the largest freighters on one line in the world. The 'Hooper' (4935) has been taken off the Boston Line for some time, and now, with her name changed to the 'Silvertown,' is running in her old capacity of a telegraph ship. Another line of 'freighters' of large tonnage is that owned by Nott & Hill, of London,—the 'Notting Hill,' the 'Tower Hill,' and the 'Ludgate Hill,'—all over 4000 tons. In fact, large freight steamers are fast becoming common, and lines which have hitherto built ships of 2000 tons are now building vessels of 4000 tons and over. A line of steamers which has recently sprung into prominence, and which illustrates the rapidity with which steamers are built nowadays, is the 'Clan Line,' owned by Messrs. Cayzer, Irvine & Co., of Liverpool. In 1878 this company had about five steamers, but such has been the wonderful growth of the line that at present there are twenty-one steamers, either now running or in course of construction; most of them 2200 tons. They are all named after Scottish clans, as the 'Clan Cameron,' etc. They run from Liverpool to Calcutta, the Cape, and Mauritius."

"The Marquis de Campo, of Cadiz, has lately become prominent as a ship owner, employing steamers in the Manila and the Havana and the Mexican trade. Nearly all his ships have been bought of other lines, and we may discover among them some old friends. Every one who has crossed the Atlantic in the famous old 'China' will be glad to know of her present situation. She is now the 'Magellanes' of De Campo's Line, while the 'Siberia' figures as the 'Manila,' and the Warren steamer 'Minnesota' assumes her place as the 'Cristobal Colon.'

"Passing over many important regular freight lines, we come to the third class, the general freighter, the vagabond class of steamer, the 'ocean tramp,' which may be in Boston one month, Odessa the next, and Archangel the third. This is a much-abused class. Popular opinion is decidely against them. They are all supposed to be worthless, rotten, poorly manned, and liable to founder in any sea heavier than that of a mill pond. That there are a great many to which this description will apply is too true. They founder, like the 'Escambia,' almost within the harbor, or more frequently are simply reported 'missing.' These unfortunate vessels mostly belong to individual owners or small lines. But there are large fleets of newly-built, stanch steamers employed in this useful trade, and at the head of the list stand Messrs. Watts, Ward & Milburn, of London, with about forty steamers, most of them comparatively new. Their steamers are found everywhere. Messrs. Appleby, Ropner & Co., London, is another large firm. The number of new companies started within the last few years for this business is surprising. At present they usually number some half a dozen vessels each, generally named as a distinct system. To enumerate them would be tedious; but we may single out Messrs. Rankin, Gilmour & Co., for their splendid steamer 'St. Ronans,' of 4484 tons, a magnificent vessel, equal in every way in appearance to a transatlantic passenger steamer.

"The few persons who pursue the shipping news have undoubtedly noticed the numbers of freighters arriving at Philadelphia and Baltimore from Benisaf and Rio Marina. These two places, which maps completely ignore, are situated in Algeria, near Bona, and in the island of Elba respectively. The freighters go there for ballast of iron ore, which they take to our Southern ports, receiving a full cargo for Europe in the place of the ore.

"Of all these thousands of steamers so few are totally lost every year that when we think of the powers of Nature and the carelessness of man in sending unseaworthy ships to sea, we cannot help being surprised at the smallness of the number of casualities."

GEORGE H. PREBLE,
Rear-Admiral U.S.N.

(To be continued.)

NOTES ON PHOTOGRAPHY: DEPTH OF FOCUS AND ANGLE OF VIEW.

THERE seems to be much uncertainty in the mind of the average non-scientific amateur about the precise meaning of the above mysterious terms; and it is to be feared that this uncertainty is fostered and encouraged by the occasional absurd and contradictory statements put forth by lens-makers' catalogues. Every now and then there is announced a brand new and entirely original combination of brass and glass, to christen which the dead languages are laid under heavy subsidies, and which, according to catalogue description, is the most rapid lens made, working with a full opening, giving perfect flatness of field, covering the plate sharp to the edges, having a miraculous depth of focus, and including an angle of 100° at the very least.

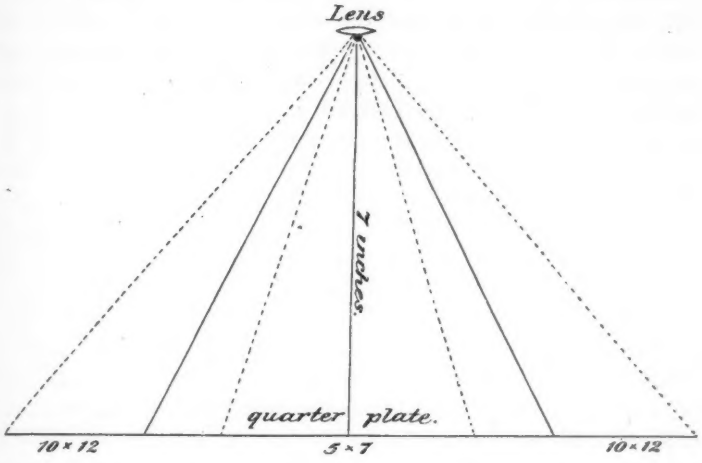
Now, it is quite possible to construct a lens—and every good optician does construct such—which will work with an opening as large as $\frac{f}{8}$, or even $\frac{f}{6}$, covering well the plate for which it is designed. But such a lens will not possess "depth of focus" with that opening, and will not include a wide angle. It is also quite possible to make lenses having great depth of focus, and including angles of over 90°. But such lenses will not work with full opening, nor will they work with lightning speed.

There is nothing at all mysterious about the terms "depth of focus" and "angle of view." They are not dependent upon any occult principle in the glass of the lens, or upon the name thereof—however sesquipedalian. Under the same conditions all good lenses—*i.e.*, those made by respectable opticians—behave, in this regard, in precisely the same manner.

1. The angle of view depends solely upon the ratio between the focal length of the lens and the size of the plate used. With lenses of the same equivalent focus, whether they are called rapid rectilinear, rapid symmetrical, rapid hemispherical, wide angle, extreme angle, apanatic, homolographic, panorthoscopic, orthopanactinic, or any other combination of the Greek alphabet you choose, a given plate will subtend the same angle. This is shown by the accompanying diagram (drawn to scale).

The lens is supposed to have a solar focus of seven inches, and the various angles which this lens would include upon a quarter plate,

a 5 x 7 and a 10 x 12 plate respectively, are indicated by convergent lines: a dark line for the 5 x 7 and dotted for the other two. The application of an ordinary horn protractor will at once show the angle included in every instance. Of course, every lens of seven inches focus will not cover as large a plate as 10 x 12; in fact very few will. But that does not affect the question. Given a plate which the lens will cover, then the angle is always the same for the same focal length. The accurate expression of this ratio between plate and



focal length of lens, upon which the view angle depends, may be of interest to the mathematical amateur. It is as follows: Divide half the base line of the plate by the equivalent focus of the lens. The quotient is the tangent of half the included angle.

2. Depth of focus, as popularly understood, depends solely upon the ratio between the focal length of the lens and its working aperture. An opening of $\frac{f}{20}$, for instance, giving practically the same "depth" in lenses of every form and name. It should be borne in mind that no lens can be made—with our present tools, at least—which will give an accurately sharp focus for all rays. From the necessities of the case, lenses have to be ground to spherical surfaces, and no spherical surface can fully meet all optical requirements. A central ray and a single *ring* of rays can be brought to one and the same sharp focus by our lenses; but no *two* rings of rays can. So that focus is, after all, only a sort of *juste milieu*—a splitting of the difference—and optical compromise. Ordinarily speaking, then, and without going into the mathematical subtleties, it can be easily proved by experiment that the more the working aperture of any lens is reduced, the greater becomes the distance through which the plate can be moved without perceptibly affecting the sharpness of the image,—in other words, the greater be-

comes the "depth of focus." And when by successive diminutions a point is reached when the aperture is a mere pinhole, there is no definite focal plane at all. In fact, the lens can then be dispensed with altogether, and a picture made by means of the aperture alone. The plate is approximately in focus at any distance, its position determining the size of the object only and not its definition.

Hence a means to do without a lens could not but be of interest, and, in fact, many serious experimenters have investigated this method to ascertain at least of what utility it could be. Its great inconvenience is that it does not admit of an exposure sufficiently short to reproduce objects in motion. But it is not a very long time since this was true even with lenses. There is no cause, therefore, to be much frightened by this long time of exposure when making use of photography without a lens. The advantage should be first considered, to indicate the desiderata, leaving to the future the realization of them. We have a conviction that it will take charge of it.

The advantages, as is well known, consist in the suppression of every lens, which is certainly something, for it costs infinitely less to buy one or several holes than to pay for a lens even of an inferior quality.

Another advantage is freedom from distortion and defective perspective. Besides, there is something which has also its charm,—that is, the immense depth of focus—if we can thus express ourselves—at our disposal; thus, objects are in focus for every variation of distance, or nearly so. We say *in focus*, but one knows that the sharpness, although sufficient for photographs of documents, leaves much to be desired when compared to that obtained with lenses. However, landscapes and buildings thus reproduced have a great softness, something which, although blurred, is not the less agreeable to the eye, and of an effect really artistic. Of all that has been said, it results that photography without a lens, taking its inconveniences into account, can render some service; the most serious of its defects is to require long exposures. At least, it is necessary to ascertain the times of exposure required according to the focal length, the diameter of the opening, and the luminous intensity. It is this to which amateurs do not sufficiently apply themselves. They make one or two unsuccessful attempts, and then they are discouraged. It is because, considering the small opening at our disposal, we must know that the duration of the exposure is excessively longer than with lenses.

For example, one can, in-doors, reproduce an engraving in one second with a lens having a diaphragm or stop with an opening of $\frac{1}{4}$ of an inch, and a focal length of 5 inches. If in lieu of the lens we employ a small opening of $\frac{1}{100}$ of an inch, everything being equal, is it not true that to know the duration of the exposure, it suffices to compare the surfaces of the two openings which admit the reflected rays? Well, the square of the diameter of the diaphragm opening is $\frac{1}{16}$ square inch. On the other hand, the square of the diameter of our

small opening, $\frac{1}{100}$ of an inch, is $\frac{1}{10000}$, and we know that the amount of light passing through two circular openings are to each other as the square of the diameters; hence the exposure will be inversely as the square of the diameters, or $\frac{1}{10000} : \frac{1}{16} :: 1$ sec. : y, which equals $\frac{10000}{16}$, or 625 seconds, which means that with the small hole of $\frac{1}{100}$ of an inch one must expose the plate 625 times longer than with a diaphragm of $\frac{1}{4}$ of an inch, or 10 minutes 25 seconds.

This calculation proves that if the above calculation is not made, the desired results will not be obtained; for an amateur will expose one minute, two, three, or perhaps five minutes, but the idea will not occur to him that he must expose more than ten minutes.

Therefore determine carefully the equivalent focus of your camera, and mark it on the tube of the lens, and measure carefully the diameter of each stop. Then divide the equivalent focus by the diameter of each stop successively, and mark the quotient on its respective stop. Thus, if the lens has an equivalent focus of 5 inches, and the stops are $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ of an inch in diameter, we have $5 \div \frac{1}{2} = 10$, or since the size is calculated as a fraction of the focal length of the lens we write $\frac{f}{10}$ on the stop, which shows that the diameter of the stop is $\frac{1}{10}$ of the focal length of the lens. Hence for the other stops we have $\frac{f}{20}$ and $\frac{f}{40}$ respectively. Now, having marked these f's on their respective stops, we will afterwards know that when $\frac{f}{10}$ takes one second to properly expose or actinize a plate, $\frac{f}{20}$ will take four times one second, or four seconds, and $\frac{f}{40}$ will take 16 seconds, for the squares of the working intensities are directly proportional to the time of exposure. Thus $\frac{f}{10^2} : \frac{f}{20^2} :: 1$ sec. : x, or 4 seconds.

Now if it is found that four seconds give a properly-timed negative with a working stop of $\frac{1}{4}$ of an inch, with our 5 inch focal distance lens, or $\frac{f}{20}$, and we desire to use a stop one inch in diameter, or $\frac{f}{5}$, by reversing the process we have $\frac{f}{20^2} : \frac{f}{5^2} :: 4$ sec. : x, solving which, we find $x = \frac{1}{4}$ of a second, assuming the object, plate, lens, and shutter-movement to be the same in both cases. This time $\frac{1}{4}$ of a second with $\frac{f}{5}$ and a fixed shutter-movement is equal in actinization, and relative in time of exposure to the four seconds of exposure above cited, and the ratio of 4 seconds to $\frac{1}{4}$ of a second or 1 to $\frac{1}{16}$ will be invariable so long as the speed of the shutter remains unchanged. Hence it is evident that if the shutter speed is changed or the aperture of the diaphragm changed, a new constant must be obtained to meet with the new conditions.

But it is readily seen that if it is desired to change the time of exposure, as, for example, to increase the time, it may be done by relaxing the tension of the spring and thus cause the shutter to move slower, or you may reduce the diameter of the stop. The diameter of the stop can be reduced to a certain known degree, therefore differences in periods of exposure should only be made by changes of the diaphragm aperture.

However, if it should become necessary to change the speed of the shutter we may estimate the size of the stop to be used in the following manner: Suppose that the shutter exposure for a particular view has been found to be $\frac{f}{20}$ and $\frac{1}{64}$ of a second, and we wish to reduce the speed of the shutter to $\frac{1}{16}$ of a second, the question then to be determined is what sized stop shall be used in order to give the plate the proper exposure, the equivalent focus remaining the same, 5 inches. Hence we have $\frac{f}{20^2} : \frac{\text{eq. focus 5 inches}}{\text{diameter of stop x}} :: \frac{1}{64} : \frac{1}{16}$. We have all the parts known in the proportion, except the diameter of the stop, which we assume as x, and by solving the proportion we find that $x = \frac{1}{8}$ of an inch, or $\frac{f}{40}$. Therefore we see that exposing a plate with an $\frac{f}{40}$ stop $\frac{1}{16}$ of a second should give the same result as if we used the $\frac{f}{20}$ stop and exposed only $\frac{1}{64}$ of a second.

The following definitions may also be of interest:

Refraction is the bending of a ray of light from its normal direction.

Dispersion refers to the power of a lens to separate white light into its components.

The optical centre is a point on the axis of a lens through which a ray of light passes parallel to its original direction.

The reason for inversion is that a correct image requires a second lens, which would exclude more or less light.

1. A pinhole has no focus, as the image is equally clear at all points.
2. A pinhole has unlimited depth of definition.
3. With a pinhole there is no distortion.
4. Upon the distance of the ground glass from the pinhole depends the size of the picture.
5. The angle of the pinhole and the size of the picture will depend upon the distance of the ground glass from the pinhole; and not one of these conditions can be obtained by a lens. Then why use a lens in photography? The principle object of the lens is to get more light within the camera.

These five principles deduçed from the pinhole constitute the fundamental properties of photography. The axis of a lens is the line joining the centre of the surfaces.

The five properties of lenses are,—

1. The focal distance of a lens is the distance from the optical centre to the point at which a distant object appears the sharpest.
2. The depth of definition is the power of a lens to give distinctness to an image of an object at different distances of the ground glass from the optical centre of the lens. The depth of definition depends upon the focal distance and aperture.
3. The angular view of a lens is measured by right lines drawn from the optical centre to the two objects the farthest apart, which are in focus.

4. Distortion is the conversion of straight lines into curves as well as the convergence of parallels.

5. The rapidity of a lens depends upon,—

(*a*) The amount of light which passes through the aperture.

(*b*) Upon the focal distance of the lens.

(*c*) Upon the shape and number of the glass surfaces through which the light passes.

(*d*) Upon the color and purity of the glass used.

Spherical aberration is due to the fact that spherical surfaces refract differently at different parts of their surfaces; so that parallel rays of light will not come to an accurate focus.

Chromatic aberration is the color effect due to unequal refraction.

This may be overcome by inserting a concave into a convex lens, the principal distances being in the ratio of their dispersive powers.

The dispersive power of crown glass to flint glass is as 33 to 50.

Upon the focal distance depends three things,—

1. The scale of the picture.
2. The angle of view included upon the same sized plate.
3. The depth of definition.

Angular aperture is the relation existing between the diameter of the stop and the focal distance.

What is meant by a wide angle lens is that you may make a larger picture than with a narrow angle lens.

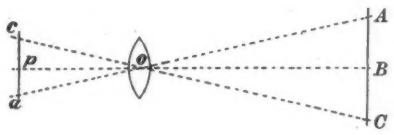
The intensity of light varies inversely as the square of the distance, thus the intensity of length at 6 inches is $\frac{1}{4}$ of what it is at 3 inches.

The amount of light passing through two circular openings are to each other as the squares of the diameters of the openings. Hence the exposure will be inversely as the square of the diameters.

The size of the opening is calculated as a fraction of the focal length of the lens. Stops marked $\frac{f}{4}$ show that the diameter is $\frac{1}{4}$ of the focal distance, and the same is true of other stop-marks.

TO FIND THE FOCAL DISTANCE OF ANY LENS.

First solution:



$op : pa :: oB : AB$

$op : pa :: op : pa$

$2op : 2pa :: pB : AB + pa$

Therefore $op = \dfrac{pB \times pa}{AB + pa}$

Thus if $pB = 75$ yds.

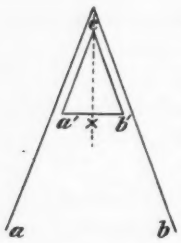
$pa = 4''$

$AB = 10$ yds.

$op = \dfrac{75 \times 36 \times 4}{10 \times 36 + 4} = 18''$

2. If the object and image are of the same size, ¼ of the distance between them will be the focal distance.

3. Focus on a distant object and then measure the distance from the optical centre to the ground glass.



4. Make two vertical lines near the ends of the ground glass and then focus on an object so as it will coincide with one line; mark the position of the camera and do the same for the other line. Bisect the angle, and erect a perpendicular equal to ½ the distance between the lines on the ground glass; draw a line parallel to the side of the angle, and measure the distance from the intersection to the perpendicular.

FOR BLUE PROCESS OF PRINTING.

1. Water 20 parts.
2. Red prussiate of potash 2 parts.
3. Citrate of iron and ammonia 3 parts.

Therefore take 40 grains of red prussiate of potash; 60 grains of citrate of iron and ammonia; 800 grains of water, or nearly one ounce, and apply mixture to ordinary white paper with sponge or camel's-hair brush, and as soon as dry the paper will be ready for use.

W. A. CAMPBELL.

AMONG OUR CONTEMPORARIES.

THE revival of the "Culte Napoleonienne," which has possessed France for the last few years, has produced very many books relating to the great emperor,—good, bad, and indifferent. Some months ago we noticed the journals and correspondence of the Baron de Stürmer, one of the commissioners sent by Austria, Russia, and France to certify, from time to time, the actual presence of Napoleon in his desolate island prison. Stürmer's reports had been lying all these years in the Austrian state paper office, and much that was interesting and curious was expected from these published pages; but they turned out to be rather "a chronicle of small beer,"—amusing enough in its way,—but revealing few new facts.

Now we have another book upon the same subject, recently published in Paris, and entitled "La Captivité de Sainte Hélene," from the unpublished reports of the Marquis de Montchenu, commissioner of the government of King Louis XVIII. in that island. The work has been well done by the editor, Georges Firmin-Didot, and is, we think, more readable than Stürmer's reports, as given to us by Saint-Cère and Schlitter. The two commissioners already named, De Montchenu and Stürmer, were joined by Count de Balmain on the part of Russia,—their appointments being due to a special clause in the treaty of August 2, 1815; and although Balmain seems to have been by far the most dignified of the trio, and on better terms with the British officials, and therefore likely to have obtained more interesting information than his colleagues, his reports, if any, are still in the pigeon-holes of the record-office of St. Petersburg.

None of these commissioners ever had an interview with the fallen emperor, who still kept up his state as regards personal introductions,—and the only view which Montchenu was destined to have of the imperial features was when cancer of the stomach had finished its work, and the former master of Europe lay dead. Montchenu began badly, for when the commissioners first arrived and demanded a reception, Napoleon said, "If they wish to pay their respects as private individuals let them address my grand marshal, and there will be no difficulty; if they wish to come as commissioners, let them send a copy of the convention, and I will see about it." About a month

elapsed after the document was sent, when Montholon replied, in a note addressed to the governor, in which the emperor protested against the treaty, and declared that the commissioners could only reach his presence by means of force and arms. Indeed, he said, "Qu'il tirirait un coup de pistolet sur la personne qui oserait franchir sa porte."

On receiving this answer, through Sir Hudson Lowe, Montchenu lost his temper,—as he seems to be constantly doing, from his own showing,—and said to the governor, "Give me a squad of soldiers, and I'll break his doors down, if necessary, to get at him." Then he tried to get his fellow-commissioners to agree to his methods, only to be reminded that he was making a spectacle of himself, as well as exceeding his instructions. Then he quarreled with Stürmer and Balmain, and for some years led a most miserable and very useless existence, writing letters to the French minister at home, complaining of everything and begging for more salary, and giving tittle-tattle which he picked up at second hand, much the same as that retailed by Stürmer to the Austrian minister. Speaking of the very strict guard kept over the illustrious prisoner, he states that: "Whenever a dog was seen to make his way about the rocky paths a sentinel was posted; and they are so multiplied in such situations that last week an unfortunate soldier, placed on too narrow a ledge, could not resist a sudden squall of wind, fell, and rolled down about six hundred fathoms, breaking every bone in his body."

The garrison of the island was a numerous one. According to Montchenu (who was, by the way, an old soldier who had been among the *émigrés* during the Revolution, and came back with Louis XVIII.), the troops consisted of six hundred men of the Fifty-third Regiment; seven hundred of the Sixty-sixth; six hundred of the local regiment; about three hundred and sixty artillerymen of the island, and a company of Royal Artillery. "There were sentinels everywhere, and no one could pass without the word."

Montchenu says that there was a staff sufficient for an army of thirty thousand men.

At sea there was the same vigilance. In addition to the "Newcastle," there were two brigs which were kept constantly circumnavigating the island. No boats were allowed afloat after sunset, a roll-call being held of the boatmen and fishermen.

Yet Montchenu says that General Gourgand told him, in a conversation had just before the latter left the island, and in answer to a direct question as to whether Napoleon could accomplish his escape, "He has often had a chance to do so, and he could do so now. What is to hinder one who has millions at his disposal. But, although I have cause to complain of the emperor's treatment, I will never betray him. I repeat that he could escape if he would go *alone* and get to America whenever he chose to do so."

Montchenu asked the general why Napoleon did not make his escape, if things were as he said, and Gourgand answered, "We have all recommended him to do so; but he has always combated our arguments and declined. Unhappy as he is in this place, he secretly enjoys the importance attached to his safe-keeping; the interest in his retention shown by all the crowned heads of Europe, and even the anxiety to gather the most trivial words which fall from his lips. He has said to us several times, 'I could not exist as a mere private individual. I would rather be a prisoner here than free in the United States.'"

When Montchenu asked Gourgand what was Napoleon's attitude towards the persons of his suite, the general replied, "That of an absolute sovereign. I have often seen him play chess for five hours on end, and keep us standing all that time."

The editor of the *Army and Navy Gazette* lately wrote: "Mr. Sala, who has been writing about flags, refers to a work by Mr. McGeorge, whom he considers to be a trustworthy guide. Mr. McGeorge's book is not to be trusted if it is therein stated that 'the English ensign is simply a red cross on a white ground; the Union flag is a combination of St. George's cross, perpendicular and horizontal, with two saltiers of the same tincture for Scotland and Ireland respectively, red bordered with white, in a blue field.' Moreover, Mr. Sala, presumably again quoting from Mr. McGeorge, says, 'The Union flag ought never to be called the Union Jack, except when it is flown on the jack-staff, a pole on the bowsprit or fore part of a ship.' But, why? There is every reason to believe that the Union flag was called the Union Jack, either because it was ordered to be flown by King James (or Jacques), or because it was a modified reproduction of the national colors as blazoned on the 'Jacks,' or coats of soldiers and sailors alike. If the Jack was so called because it was flown on the jack-staff we could understand the contention; but this is not so. The jack-staff is a thing of to-day almost, and is so called because it was put up to fly the Jack forward when the sprit-topmast was abolished. But the Jack is not only flown at the jack-staff, and long before such a staff was in existence it was flown at the mast-head and at the mizzen-peak as well as elsewhere. It is often forgotten that the 'Jack' (or flag of King Jacques) was put away in the commonwealth times, and that Blake and Penn fought their battles under another flag 'with the harp in the fly.' It would be more correct to say that the 'Union Jack' is a diminutive or nick-name for the Union flag."

Mrs. Hobbs, of Barnaboy, Ireland, lately celebrated her one hundredth birthday, with members of her family to the fourth generation

about her; and one of her grandsons is himself a grandfather, thus making her a great-great-grandmother. Mrs. Hobbs is the widow of the late Captain Hobbs, of the Ninety-second Highlanders, who served in the Peninsular War, and was afterwards at Waterloo, where he was wounded. Of Mrs. Hobbs's fourteen children, five were sons, all officers in the army. Two of them were in the Crimean War, and one in the Kaffir War of 1850–53, and in the Abyssinian campaign.

She has now five grandsons serving in the army. "On the occasion of her centenary," says the *Army and Navy Gazette*, "she received a telegram from the Duke of Cambridge, congratulating her. 'Understanding you to-day attain the age of one hundred years, I desire to offer my congratulations to you as the widow of a distinguished Waterloo officer, whose five sons have served the Crown, as your grandsons are also now doing.'" The paper quoted states that the lady is in possession of all her faculties, except that her hearing is not good, but her memory of events which happened at the beginning of this century is wonderfully clear.

The following editorial remarks, from the *Army and Navy Gazette*, will be read with interest by officers of our own services, we are sure, owing to recent decisions:

"The papers have recently had a good deal to say concerning a 'new departure' taken by the Admiralty in regard to inventions and discoveries made by naval officers and by those engaged in the administrative, instructional, experimental, and manufacturing departments. Naval officers know very well, and know somewhat to their cost, that the new regulation is in fact an old and familiar regulation reissued. The conditions are exactly the same. The Admiralty has an absolute right in their inventions. It may take them at its own valuation, if it so chooses, or it may reject them, and they cannot take out a patent without permission. Speaking generally, it may be said that naval officers, except such as have been unfairly dealt with, feel little hardship in this. What they claim is that a Brennan or a Sims-Edison torpedo shall not be purchased at a prodigious figure, while inventions of their own are either shelved or remunerated at a quite ridiculous sum. There are many examples of this. The position of the Admiralty is comprehensible. Those in their service have command of vast and most costly material, and are by the nature of the case in the very best situation for making inventions of practical utility. Should they expect as much, says the official mind, as those who have had to provide all the groundwork for their labor. So far the contention may be right; but, on the other hand, what is the result of an illiberal policy? Does it not immediately chill enthusiasm and discourage endeavor? Can a naval officer, who is generally fully absorbed

in his professional duties, be expected to devote his scanty leisure to inventions which will bring him but a paltry reward? It is not the regulation that needs to be changed, but the spirit in which it has sometimes been administered. The true policy is to encourage investigation and stimulate discovery. We hear there is dissatisfaction among contractors to the Admiralty at the treatment they have recently received.

If Russia had completed her great Siberian Railway when the Corean difficulty began, perhaps matters would have assumed a different complexion. Nevertheless, since the Czarewitch formally began the work, in March, 1891, at Vladivostock, the Pacific seaport, the portion lying between that point and Irkutsk has been nearly completed, while much of the work west of that city is in process of construction or finished sufficiently to contribute to the more rapid construction of the rest of the vast line. Among the most formidable of the difficulties encountered are the crossings of the great rivers, which generally run from south to north, and which require bridges with huge embankments to form the summit level on each side of them.

Then there is the valley of the Irkut, where the road has to be built in cuttings blasted from the overhanging granite ledges and crags; and at one of the mountain chains which bars the way a tunnel about eight thousand five hundred feet in length has to be constructed. In fact, there are great natural obstacles to be met all along the line, increased by the desolation of much of the country, which necessitates the hauling of everything required for the work, as well as the laborers to accomplish it for very great distances.

It is reported that the Russian government has already under way furnaces for smelting iron ore, and mills for making rails at several points, thus lessening the cost and facilitating construction. In spite of the productiveness of much of the Siberian territory which will be opened by the road, it is not expected that it will pay its way for many years to come; and, possibly, it might never have been begun but for its immense military value.

The *United Service Gazette* in its notices of magazines, says, "The *Cornhill* has an article which contains some interesting particulars regarding commissions in the German army. The writer of the article, in comparing the conditions regulating the German army with our own, observes that in this country, owing to the smallness of our army, the competitive examination for commissions is a *sine qua non*, there being almost invariably an unlimited supply of young men of means ambitious of holding Her Majesty's commission.

"In Germany the conditions are reversed, and the demand being in excess of the supply, no resort need be had to competition. With regard to the entrance examinations, the writer observes that so far as mathematics or the dead languages are concerned there is no great difference beyond this, that the English standard is decidedly higher. In history the contrast is more apparent. The German authorities consider it essential to the education of an officer that he should be well up in the history of the chief European nations as well as that of the Middle Ages, and of ancient Greece and Rome, whereas a general knowledge of his own is deemed enough for a British officer, and not even this is compulsory. The value attached to a colloquial knowledge of modern languages affords, perhaps, a still more striking contrast. It is true that under the German scheme such knowledge is not obligatory. There is, the writer tells us, a wide divergence in the rules of the two countries which fix the age at which a candidate is admissible to the literary test, the German being eligible up to the age of twenty-three, whereas the English maximum is nineteen."

The same English journal, speaking of imperial federation, gives the following figures:

"With the exception of £85,000 spent by the seven Australasian colonies for ships of their own for coast and harbor defense, and a sum not exceeding £126,000 per annum they undertake to pay towards the maintenance of a certain number of ships of the British navy on the Australian station, the Royal Navy, which is employed and relied upon for the protection of the whole empire, is provided and maintained entirely at the cost of the people of the United Kingdom, although there are eleven million people of the same race inhabiting some of the richest countries in the world under the same sovereign and enjoying the same privileges. It is not considered to be at all primarily the fault of the colonies that such should be the case, for they have never been asked to contribute."

In September last a small military balloon was struck by lightning at the camp at Aldershot, England, while the sappers in charge were hauling it down. They were winding the wire rope (of which about two hundred feet were paid out) by means of a winch, the handles of which were covered with brass. Three of the men were struck down, and seriously but not fatally injured. One of them had the inside of his hand badly burned; but the worst case showed no signs of external injury. An English service journal, in speaking of the event, says that a somewhat similar occurrence took place in Italy some years ago; and the *United Service Gazette* recalls the fact that Richmann, the

Russian physicist, was struck dead on the spot while repeating Franklin's well-known demonstration of drawing down an electric spark from the clouds by means of a kite furnished with a sharp steel point at its head. The quantity of electricity derived in this way is, as Faraday showed, comparatively small, but its intensity is extremely great, and herein consists the danger to any person at the termination of the string of a kite or of the rope holding a captive balloon. That paper then goes on to say that, as the exigencies of war will often not permit of the choosing of any particular kind of weather for balloon observation of an enemy's position, it is obvious that some mode will have to be devised for conducting any electric current harmlessly to the ground.

In this Aldershot occurrence the upper part of the balloon was consumed, but the metal valve was uninjured. The car (which was fortunately unoccupied), with a heavy bag of sand ballast, fell to the ground without injuring any one.

This event reminds the writer of an occurrence which took place on board of a sloop-of-war to which he was attached many years ago. We were coming out of Table Bay, Cape of Good Hope, with beautiful weather and a moderate breeze. When near Robben Island (since so well known as a leper settlement, and at that time some sort of a penal establishment), a small white cloud—almost the only one in sight—floated high above us. When directly over us there was a single flash and report of sufficient force to make the ship tremble; but in a moment it was seen that no one was hurt, although several sustained slight shocks. The only damage done was to our conductor. This was one of the old-fashioned ones of long links of thick wire, which came from a spindle at the main truck, was stopped to the royal backstay, and trailed overboard from the main chains. Usually this was carried in the chains, and only dropped overboard when thunder was heard; but on this occasion it was (by oversight) trailing in the water. The wire was melted in several places, coming down on deck in molten particles and long sections, while the spindle, several feet long, came down perpendicularly, penetrated the deck plank of the starboard gangway, and stood there quivering. It struck but a foot or two from where our carpenter was standing,—a close shave for him. As we have said, it was a beautiful day, and there was no other cloud to be seen except this small, floating, balloon-like one, not much "bigger than a man's hand," yet with capacity for serious damage.

William O'Connor Morris's last article upon Moltke, in the *Scottish Review*, winds up as follows: "He was never tried by what is the true criterion of generals of the highest type; he never was victorious with an inferiority of force; he never made genius supply the want of

numbers; he did nothing that can be compared with what Napoleon accomplished in 1795, in 1814, and even before Waterloo. It may safely be affirmed, as we survey his career, that he could never have achieved exploits like these: strong, patient, able, but requiring time to work out what he had designed, he could not have carried out the movements that have made Arcola, Rivoli, and Montmirail immortal. Nevertheless Moltke holds a real place, if not the highest, among great commanders; he was admirable in executing operations in the field, grand, complicated, vast, and often very difficult, based on plans he had laid down beforehand; here his power of organization appears again; and on several occasions he certainly gave proof of the readiness, the daring, nay, the perfect skill which generals of renown possess. Had he been a younger man when he first directed war, his military career might have been more brilliant.

"To superficial observers the most striking feature in the great wars conducted by Moltke was the superiority in organization of the German armies. Their celerity, their ease and power in manœuvring, were as remarkable indeed as their immense numbers, and as the skill and good will of their chiefs in acting in concert. From these facts it has been inferred that mechanism, and not genius in war, is the most decisive element of success; Moltke, it has been said, 'has displaced the axis of ideas in the art;' a great organizing chief ranks higher than a great commander. This is a false and most dangerous notion; and Moltke himself has protested against it. That mechanism and organization can do much in war is a truism on which we need not dwell; but superior direction has always been, and will always be, the dominant force that decides the issues of campaigns and battles. The wars indeed of 1866 and 1870 exhibit this truth with remarkable clearness. Napoleon, even with Benedek's army, would probably have overthrown Moltke, in the advance into Bohemia on a double line; the Germans must have lost Mars la Tour, would have had, it is likely, their communications severed, and would have not been successful at Gravelotte, had Moltke had a real general in his front. Assuredly Wellington, in Macmahon's place, would never have marched an army to Sedan, but would have fallen back and defended Paris, a movement which would have given a new turn to the war, and have saved France from an ignominious peace. The issues of war in their main results depend on the powers of man more than on anything else; mind rules matter, and will always rule it; a great captain, with forces even nearly equal, will subdue an adversary of inferior power."

The *Deutsche Heeres-Zeitung*, speaking of the War Academy, says that this high school of war has in some degree ceased to answer the demands of the present day, and yet were it possible to have una-

nimity of opinion on the subjects which require modification, a valuable reform must necessarily be a very gradual operation.

The principal points to be considered are: 1, the number of years to be passed at the Academy; 2, the subjects to be taught; 3, the number of officers admitted to attendance; 4, the number and position of the professors, as well as the extent of their attainments,—besides several other important matters.

It would seem better to separate the department of technical teaching from that of the tactical, and of general science; and with this view a commission is already engaged in the consideration of a superior technical school.

One fact will show how many more are anxious to be admitted to the present War Academy than there are vacancies for. Last winter a well-known general organized, in Berlin, for the benefit of officers of the army on active service, courses of study analogous to those of the Academy, and, in a very short time, had as auditors more than sixty officers of the guard corps. The chief of the general staff has also at heart the transformation of the War Academy, and has already ordered that, during the coming year, the course upon military geography is to be omitted,—which gives general satisfaction, according to the journal from which these facts have been taken.

Speaking of the necessity for bilge-keels in ships of the modern navy, the *Nautical Magazine* says that during a passage from Stornaway to Greenock, in a calm sea but heavy swell, H. M. S. "Royal Sovereign" rolled thirty-three degrees, and the "Empress of India" twenty-eight degrees. Neither of these vessels had been fitted with the simple and effective bilge-keel, whose controlling power in a rolling ship nearly a child might be able to foresee. In company with the squadron was H. M. S. "Repulse." She was provided with bilge-keels, and the utmost rolling under their effect did not exceed eleven degrees, or just one-third that of the "Royal Sovereign."

These facts, the magazine says, were somewhat tardily and unwillingly admitted by the secretary of the Admiralty; and arrangements are now being made to fit all first-class battle-ships with bilge-keels,—"keels which, when the 'Resolution' was designed, it was authoritatively said were no good. Verily experts live and learn, just like common, ignorant people."

The ship- and engine-building firm of William Cramp & Sons earned as premiums for speed, over and above the contract price, about seven hundred and fifty thousand dollars, for the two cruisers "Columbia" and "Minneapolis;" and altogether up to this time they have

received for seven vessels one million two hundred and thirty thousand dollars in speed premiums.

No one begrudges the Cramps their success, and the money would be well earned if only as a demonstration that as good ships can be built in this country as anywhere in the world.

They have now in hand the "Indiana," the "Massachusetts," the "Iowa," and the "Brooklyn," armor-clad vessels, exceeding in displacement anything now in the service; and a contemporary remarks: "It would not be extravagant, apparently, for this firm to expect at least six hundred thousand dollars more, as the aggregate of premium for extra speed from these four ships, thus increasing their earnings to one million eight hundred thousand dollars from that source. Still, the government receives value for all this extra outlay. The "Minneapolis," for example, is specially built for service, in time of war, as a commerce destroyer and commerce protector. Her contract called for twenty-one knots, but by making twenty-three she is vastly increased in efficiency, because the great ocean racers which she might need to overtake are becoming faster and faster. The very fact that we have cruisers like the "Minneapolis" and the "Columbia" is, as Secretary Tracy once pointed out, to some extent a guarantee against being attacked by a nation which has a great merchant marine exposed to capture."

In speaking of the conflicting and uncertain reports which came from the seat of war in the extreme East, a very wise and conservative daily paper remarked, "But as Japan wisely keeps newspaper correspondents away from the front, as Sherman tried to do during the war, the reports are evidently guesses made at a safe distance as to what is going on. With modern means of flashing intelligence around the world, newspaper correspondents, however worthy they may be, are just as troublesome as spies. The news they send of operations may be flashed back to the enemy after it has circled the globe in time to be of service for defense. The knowledge of this fact will make it increasingly difficult hereafter for the war correspondent to get to the front."

This is undoubtedly the correct view to take of the subject, but will not be agreed to by some of the enterprising correspondents, who really appear to believe that warlike operations are conducted for the purpose of furnishing "copy."

The foot-gear of soldiers was the subject of an interesting paper, by an officer of our army, in a late number of the *Journal of the Military Institute*, and now we condense some remarks upon the same subject from the *Army and Navy Gazette*. This paper refers to a lecture delivered by Surgeon-Captain Beevor before the Royal United Service

Institute on "The Soldier's Sore Foot," as well as a paper by M. Schreiner in the *Revue Française*.

The English writer showed that the lowest loss from sore feet that a force can anticipate at manœuvres will amount to ten per cent., in spite of all care and previous preparation. On service the proportion has amounted to twenty-five, thirty, and even fifty per cent.,—which seems out of all reason,—the main cause being a boot faulty in form or unfit for rough service. The French writer is satisfied with their present infantry boot, but wants a "leg" of some four or five inches to cover the lower edge of the pantaloon. He advocates pantaloons instead of trousers, similar to those at present worn by the Hungarian Infantry, loose above the knee, and gradually tightening to fit the leg, and buttoning close round the ankle. He also advocates canvas shoes with rubber soles—like those which the boys and girls at sea-shore places call "sneakers"—to be worn in bivouac in the neighborhood of the enemy, thus resting the feet while keeping them ready shod for a night alarm.

M. Schreiner contends that in swampy country or rainy seasons the best boots are no good. He says he has tried all kinds, leather, canvas, and rubber, from a sandal to a long boot, and that all became water-soaked and softened the feet. It was best, under such circumstances, to go barefooted. During nine months of service in New Caledonia the men of M. Schreiner's detachment never wore boots except for night guards, and he says they were perfectly able to march over coral beaches, stubs, and stubble. The reason for their going barefooted, in the first place, was that they were sent to a detached post at short notice, without supplies, and without possibility of obtaining them. The officer in command noticed that, on the march, some of the old soldiers took off their boots in order to save them for future eventualities, and, taking the hint, he caused the whole command to do likewise. It was well that he did so, for they were three months without supplies, and when they did come, the boots were found to be of the wrong sizes. Luckily the men's feet were by this time hard and fit for any march. M. Schreiner is of opinion that the soldier should be practiced in peace time in marching barefoot; but, of course, that would so much depend upon climate, season, and the character of the troops that it is hardly worth serious discussion.

Mr. W. G. Thorpe, F.S.A., in his recently published amusing book, "Middle Temple Table Talk," speaks of a trade which we do not remember to have heard of before, and which even Zola omitted to mention among his battle-field horrors. He is speaking of the time when human teeth were used by dentists to supply deficiencies, instead of the artistic porcelain ones now inserted. "For this traffic men

attached themselves to Lord Wellington's armies in the Peninsula, and as soon as the battle was over and darkness fell on the scene of slaughter, went out on the field with their forceps to abstract the molars of the young and healthy dead. These men took out licenses as regular sutlers; but, once on the field, they plundered the pockets as well as the mouths of their contents, and were suspected of not infrequently giving

'Another stab to make the case more sure.'

"It was a risky trade, for any soldier who saw them practicing their hideous traffic would at once bestow a bullet on them. Yet it paid well. Harnett, one of the greatest exploiters of it, died worth seven thousand pounds; and another of them, Cronch, got so much money by it as to be able to build an hotel at Margate; which prospered until his former occupation came out, when it was at once shunned, and he had to leave it."

On another page Mr. Thorpe, who has been speaking of the tradition that Shakespeare died as the result of a drinking bout with Drayton and Ben Jonson, in April, 1616, instances a modern occurrence of the same kind which might be called a naval engagement, and which occurred in 1848. "I myself remember the standing contest between Dundee and Glasgow being fought over again at Dunoon on the Clyde; the champions were not of the pot-house order, but an admiral and a large Glaswegian ship-owner. The ordeal was as to the greatest number of tumblers of whisky-punch which either side could consume in a long autumn afternoon, between a one-o'clock dinner and supper. Both men went as he pleased, with a friend of his opponent's tallying the mutchkins, but in the end the record remained unchanged. The 'Glaskie body' found room inside for twenty-two, which should be five and a half pints of whisky, but he was beaten by the Dundee man, who, as usual, scored twenty-four, or six pints of alcohol,—three quarts! three-quarters of a gallon!! four and a half bottles!!! Here it was not 'one' party who died of the bout, as in Shakespeare's case, but both. The child of the Clyde was dying when they removed him from the carpet on which he had fallen; the son of the Dee died at the hotel, to which he was removed, within a week."

Andrew G. Curtin, the "war governor" of Pennsylvania, died in October last, at a ripe old age. His name headed the list of loyal governors who signed the address to President Lincoln, dated September 22, 1862, in which they pledged the resources of their several States to the prosecution of the war. This momentous action was taken at a critical period of the Civil War, and put an effectual check upon the machinations of the peace party.

From that time until the end of the war Curtin was frequently called in consultation by Mr. Lincoln, who regarded him as one of his stanchest and most reliable supporters.

Curtin was elected governor of Pennsylvania in 1860, and at once took his stand as an advocate for the suppression of secession by force of arms; and this at a time when very many prominent and intelligent as well as patriotic men were hesitating over what was to be done, while some doubted the necessity of using force, and others questioned the right of government to coerce seceding States.

Curtin never doubted, and never faltered. He not only promptly responded to the government's call for troops, but he raised a body of twenty-five thousand men, on the requisition of General Patterson. This requisition was revoked by the Secretary of War, for reasons which it is not necessary to refer to now, and Governor Curtin obtained authority from the legislature to equip them at the State's expense.

This fine body of troops became known as the Pennsylvania Reserves; and, their services being soon accepted by the general government, they won for themselves and their State a distinguished name on many battle-fields, being for a part of the time maintained as a distinct and compact body of Pennsylvania troops.

While in the field they were quite as frequently called "Curtin's Reserves" as by their proper official designation, and were as well known by the enemy as by our own troops. A story is told of one of them, when on sentry on one side of a Virginia stream, entering into discourse with a gray-back, who was similarly posted on the other side. The "Johnny" seemed very anxious to know what regiment and division of the Army of the Potomac was in the immediate neighborhood. The Union soldier at last told him that he belonged to Sykes's Regulars.

"Oh, no you don't!" shouted back the "Johnny." "I don't believe you're nothin' but one of Curtin's Preserves."

Whether the story was true or not, the name was often given them in joke, but only good naturedly, for they commanded the respect of all for their *esprit de corps*, fine behavior in action, and cheerful, uncomplaining spirit, under the most depressing circumstances.

The "Souvenirs Intimes d'un Lancier de la Garde Impériale," by Marcel de Bailhache, published lately in Paris, tells us nothing new of the battles or the siege of Metz, included in the garrison of which the author was made prisoner, and sent to Germany. Brought up in Alsace, he spoke the language of the victors, and was able to hear more of what was going on than most of his brother officers, and his account of his captivity is therefore interesting.

At Cologne, where the officers of the guard were sent for distribu

tion as prisoners on parole, he tells us that, after a very good breakfast, they asked for something to drink, and were astonished to find that they must pay for wine or beer if they wanted it. Then a major of landwehr addressed them as follows: "Gentlemen, it is reported by the police that certain French officers have been heard to abuse their emperor in the cafés. The Emperor Napoleon, gentlemen, is a prisoner, like yourselves, and in his unhappy condition, should have your respect. You are to understand that no one will be allowed to insult him, and any one of you who is found doing so will be put in close confinement in a fortress." The French officers were treated very well, from the author's own account, and were allowed to retain and wear their swords. At Bad-Dirbourg, where Bailhache and about fifty others were interned, not a uniform was ever seen except that of the postman; and some of the party thought it a favorable opportunity to break their parole, and reach home, but were dissuaded by their more sensible and honorable comrades.

The Germans allowed twelve *thalers*, equal to about forty-five francs, a month to each officer of the grade of *sous-lieutenant*, for all expenses of board and lodging; a small sum, as Bailhache remarks, for those who had no private means, especially during the rigorous winter of 1870–71. Those who could afford it fitted themselves with fur caps, overcoats, and high boots, and managed to be pretty comfortable. Those who could not raise the funds for such clothing had to hug the high tile stoves pretty closely. The author and his companions were afterwards transferred to Münster, which town they appeared to have enjoyed, and especially so the sight of the female population on skates upon the frozen lake. Bailhache says that the German officers of the garrison went skating in uniform, and with their swords on. But they appear to have been very good fellows, for the major who had charge of the prisoners' letters, being ordered to open them, always cut the envelope in the presence of one of the Frenchmen, and then handed them over unread, after having obeyed the order literally. But Bailhache says that the treatment of the French prisoners sent to Brandenburg and Posen was very different from that which he and his comrades experienced.

E. Shippen.

NAVAL AND MILITARY NOTES.

NOTES AND DATA ON NAVAL AND MILITARY MATERIÉL AND ALLIED SUBJECTS.

It is the intention to collect and publish in this department of the "United Service" all information obtainable from current publications and other available sources concerning ships, guns, armor, explosives, small-arms, military and maritime affairs, and kindred subjects. As the data are derived largely from unofficial sources, strict accuracy cannot be expected; but all reports will be carefully examined and compared with others on the same subject, and it is hoped, by this means, to attain fairly correct results. Erratum notices will be published whenever errors are discovered in data previously given. As the development of the present plans for collecting information progresses, it is hoped to secure fuller and more authentic reports.

ABBREVIATIONS USED IN THE NOTES.

b.l. = *breech-loading guns of ordinary (not rapid-fire) type.*
cm. = *centimetre.*
f.a.m.l. = *fore and aft midship line.*
I.H.P. = *indicated horse-power.*
l.w.l. = *load water-line.*
m.g. = *machine gun.*
mm. = *millimetre.*
pr. = *pounder (as 6-pr.).*
r.c. = *revolving cannon.*
r.f. = *rapid-fire.*
r.f.g. = *rapid-fire gun.*

HEAVY GUNS AND MOUNTS.

BRITISH ADMIRALTY, 4.7-INCH, MARK III., PEDESTAL MOUNT.—The new British Admiralty, 4.7-inch, Mark III., pedestal mount is practically identical with the Elswick design. The weight is taken on ten 1-inch steel balls traveling in a brass rack. The new mount weighs considerably less than the old central-pivot type, and the weight saved has been utilized in the shields, which have been improved in shape and increased in thickness. The sliding roof of the new mount is three inches thick, and all parts of the shield are sufficient to resist the attack of 6-pounder projectiles at 700 yards, 3-pounders at 100 yards, and 1-pounders at all ranges.

UNITED STATES NAVAL 13-INCH B. L. R.: DESCRIPTION, TRIAL.—The mount is similar to that of the 10-inch, and has independent in-and-out motors. The guns differ from other B. L. R. guns of the navy: in having four lands and blanks on the plug and in the screw-box; in having the mechanism for operating the breech-plug almost wholly in the metal of the gun itself and thus having it wonderfully well protected; and the weights of mush-room and plug are proportionately less than in the smaller calibres. The following are the principal

DETAILS OF CONSTRUCTION.

	Inches.
Length of tube	460.7
" " jacket	204.0
" " screw-box	18.4
" " gun from breech-face to muzzle	479.0
Diameter of gun over A hoops	49.0
" " " at muzzle	21.0
" " powder-chamber	15.5
" " screw-box over lands	21.5
" " " " " blanks	22.75
Thickness of tube over powder-chamber	4.5
" " " under forward A hoops	5.75
" " " at muzzle	4.0
" " jacket	6.5
" " A hoops	5.75

The gun consists of a tube, a jacket, four breech-hoops, five chase hoops, and two screw-locking hoops. The breech-hoops are designated A_1, A_2, A_3, A_4; the chase hoops, B, C, D, E, and F; and the screw-locking hoops, G and H. G locks F hoop to the tube and H locks A_4 hoop and B hoop together. From G hoop to the muzzle, a length of 84 inches, the tube projects unhooped. A_4 hoop is gradually turned down to a diameter of 46.5 inches; but above the turned down part, in turning, are left three circumferential ribs or lugs of the former full diameter. Over the forward end of this hoop screws H locking hoop, abutting close up to the forward lug. The three forward lugs and straps of the saddle fit in between and in rear of the lugs. The saddle has two other straps around the smooth surface of the gun, some distance farther to the rear.

The mechanism for operating the breech-plug is as follows: A vertical shaft extends through the metal of the breech with its axis about four inches from the breech face and about the same distance from the screw-box. This shaft carries on it a worm-wheel and a worm, and also forms the axis for the plug-tray. The crank-shaft extends into the gun horizontally, forward of the vertical shaft and a little below the level of the top of the screw-box. On the crank-shaft is a worm which gears into the worm-wheel on the vertical shaft. The worm on the latter is just above the upper journal of the plug-tray, and is very short (measuring along the axis of the shaft); its pitch is about 30°. Along the circumference of the breech-plug, at the rear end, is cut a gear to match the thread of the worm and which extends around about one-sixth of the plug's circumference. Its upper end is in the middle of one of the lands of the plug. The gear cut on the plug is then carried along the surface of the plug as a worm-rack parallel to the axis, and a narrow strip of the land through its middle is thus cut away. The pitch of this worm-rack or gear is the same as that on the rear part of the plug, and is equal to 90° minus the angle of pitch of the worm on the vertical shaft (which permits the latter worm to work in it). The action of the plug mechanism is as follows: When the crank is turned the worm on its shaft, gearing into the worm-wheel on the vertical shaft, revolves it. The worm on the shaft is therefore driven and, mashing into the circumferential gear on the rear part of the plug, turns the plug. When the worm has reached the end of the circumferential gear the plug can no longer be turned, and the worm continuing to revolve, mashes into the threads of the longitudinal rack and forces the plug to the rear. When the end of the longitudinal gear, or rack, is reached a further turning of the crank compels the plug-tray to turn about its axis (which is, as before stated, identical with the vertical shaft) through an angle of about 135° and carry the plug clear of the bore. Reversing the direction of turning the crank reverses all the above-described movements and enters and secures the plug. The simplicity of the operation is very striking when seen, but is difficult to describe clearly and concisely. This simplicity is further enhanced to the eye by the concealment of nearly all the parts within the metal of the gun. Nine turns of the crank are required to unlock the plug, and nine to withdraw it and turn it clear of the bore. Under ordinary conditions one man can operate the lever without difficulty, but two should be stationed at it for rapid-working, especially if there is a tendency of the plug to stick.

The proof of the gun included proof of the powder, which latter was not very satisfactory, the pressure exceeding the service limit without giving the required velocity. The results of the firings were:

Charge (lbs).	Velocity (ft.).	Pressure (tons).
403	1720	10.2
461	1851	12.3
482	1975	14.8
526	2003	17.1

The pressure-gauges in the last round did not agree closely. And the increase of pressure recorded is out of proportion to the increase of velocity, but about what would be expected from the increase of charge. The requirements of the powder are 2100 f. s. $\pm$ 15 f. s., and a pressure not exceeding 15 tons per

square inch. The sample of powder furnished was therefore rejected.

Everything connected with the mount worked well, except one pressure-pipe, which had to be repaired. The recoil was practically the same for each round, varying from 47 to 47.5 inches. The design admits of 52 inches. The recoil under ordinary circumstances will be considerably less. Owing to the weakness of the pressure-pipe, the hydraulic pressure had been reduced merely one-third.

The powder-blast, as was to be expected, was severe. The axis of the piece was about 8 feet above the ground. The force of the blast was nevertheless sufficient "to pull up a heavy T-rail spiked down to a heavy longitudinal, and more securely than in the case of a railroad, and throw it several feet away." A 12-inch shot, weighing 850 pounds, lying under the path of the projectile, a short distance from the muzzle, was jumped off the ground. The effect of the discharge on the ear is less unpleasant than that of the 8-inch or lighter calibres, unless one stands too close to the line of fire. The report is lower-pitched, and less quick and sharp, and, therefore, less annoying to those operating the gun.

GRUSON MINIMUM-PORT GUN-CARRIAGE: TEST.—By direction of the Ordnance Department of the United States army, a preliminary test of the "Gruson Minimum-Port Gun-Carriage" has been made at Sandy Hook, by firing three rounds from a 12-inch gun mounted on it. The carriage was purchased from Krupp, and is intended to serve, if satisfactory, as a type for casemate carriages. The carriage is called "minimum port," as it requires but a small port for a considerable range of train or elevation.

16-INCH GUNS FOR COAST DEFENSE.—Machinery is now being installed at the Army Gun-Factory, at Watervliet, for the manufacture of 16-inch guns. The lathes will also be adapted for use with guns of 12-inch and 14-inch calibre. The machinery will not be ready for use for some months yet, but when ready it is expected that guns of the largest size will at once be undertaken.

NEW TURKISH GUN-FACTORY.—The Turkish Admiralty has completed the new gun-factory at Constantinople, and it is now ready for work. The plant is designed for the construction of guns up to and inclusive of a calibre of 36 centimetres (14.17 inches). An Englishman has been appointed superintendent.

BUFFINGTON-CROZIER DISAPPEARING GUN-CARRIAGE: DESCRIPTION.—On December 14, 1893, a Buffington-Crozier disappearing gun-carriage, mounting an 8-inch breech-loading rifle, was tested at the Sandy Hook Proving Ground with most remarkable results. It required only 12 minutes and 8 seconds for this carriage, worked by seven gunners, to fire ten shots. The wonderful aspect of this performance will be understood when it is explained that with every shot the rifle, weighing 33,000 pounds, was lifted from its loading position, and projected forward as though over a parapet. As the shot left the muzzle, when fired, the gun, recoiling without a jar, settled lightly upon its carriage-bed ready for the next load.

The underlying principle of the mechanism is founded upon the geometric theories that if a right line move so that two of its points remain upon two other lines making an angle with each other, the extremity, or any other point of the moving line, will describe an ellipse. The trunnions of the gun are mounted at the ends of two levers, which in turn are mounted at their centres on two hydraulic buffing cylinders, which are placed one on each side of the top of the carriage. The other ends of these levers carry the counterweight, a mass of metal weighing 37,000 pounds, placed in the centre of the carriage under the gun. When the gun is in the loading position, the hydraulic cylinders are thrown to the extreme rear end of the carriage, carrying with them the trunnions of the supporting levers and raising the counterweight, which is held in its elevated position by a system of pawls and ratchets. When the counterweight is released, it throws the rear ends of the gun-bearing levers forward and upward. The buffing cylinders are drawn forward over their stationary pistons to the front end of the

carriage. At the same time the breech of the gun is carried up by steel arms, whose upper ends are pivoted to the gun, and whose lower ends are pivoted to sliding blocks which move in circular grooves, and which may be raised or lowered to give the desired elevation. When the discharge occurs, the force of recoil throws back the upper ends of the levers, which, in turn, force the cylinders to the rear end of the carriage and raise the counterweight to its original position, where it is caught and held by the pawls and ratchets. Neither the gun nor any part of the carriage is exposed above the protecting parapet except for the instant of firing. The carriage allows a total vertical range of 20°, 15° of elevation, and 5° of depression. It is calculated that two-thirds of the force of the recoil comes upon the hydraulic cylinders, the other third being used in raising the counterweight. It will be seen that the first movement of the gun at discharge is along a path nearly horizontal, and that the final movement, as it disappears behind the parapet, is nearly vertical. In the final test each shot weighed 400 pounds, and was fired with a charge of 125 pounds of brown prismatic powder.

The carriage weighs 100,000 pounds. The steel castings were furnished by the Midvale Steel Company, of Philadelphia, and the work was done by the Southwark Foundry and Machine Company, of the same place.

The record made during this test has no equal in the history of modern ordnance. It excels the rapid-fire tests of 8-inch guns at Annapolis, where the rifles were mounted on stationary carriages of ordinary pattern, and where eight shots in 10 minutes and 20 seconds was the best work done. Further than this, it places at the disposal of the government a disappearing gun-carriage unequaled by anything of the kind employed abroad.—*Proceedings of U. S. Naval Institute.*

CANET ELECTRIC TURRET MOUNT FOR A SINGLE GUN.—The new design of this mount has been adopted for the ships now under construction by the Société des Forges et Chantiers de la Méditerranée. It closely resembles the mounts for the *Latouche-Tréville*, the *Pothuau*, and the Danish coast-defense ship *Skjold*. The mount complete consists of the following parts: (1) The turret; (2) the turret-supports and protection; (3) the mount proper; (4) the electric gear.

The turret is of elliptical plan, eccentrically pivoted in order to balance the weights about the centre of support, which is also the centre of pivoting. The turret cover, which is slightly crowned, is of thin steel plating. A little to the right of the centre and directly above the operating platform (which is attached to the mount and will be referred to later), an armored sighting hood rises above the turret cover. The floor of the turret, called the platform, supports the mount. The framing beneath the platform carries on its lower side a ring resting upon coned rollers arranged in the usual manner. Inside the circle of coned rollers (which are supported from the armor deck) a hollow cone (or rather, frustrum of a cone) of thin steel plating is bolted, base upward, against the framing of the platform. Its base is the full size that the inside diameter of the roller-path permits. It extends downward to within a few inches of the inner bottom of the vessel where it ends in a thick circular plate of about half the diameter of the base. This plate carries a bearing for the head of a small ram supported by hydraulic pressure. The weight of the turret and contents is partly supported by the ram and partly by the rollers, but chiefly by the former, in order to reduce the power requisite for training. Beneath the turret, extending from the lever of the lower edge of the turret-armor to the armor (or protective) deck, and resting upon the latter, is a fixed circular armored redoubt surrounding all parts of the mechanism between the turret and armor deck. Surrounding the supporting cone, below the protective deck, is a geared rack, connected by gearing to the driving worm of the electric training motor. The motor is operated and training effected by a lever beside the man at the sighting hood.

The ammunition hoist consists of an endless chain with bearing pieces, or

ammunition carriers, at short distances apart. It is enclosed in an oval-shaped brass tube extending from the left side of the gun down through the cone almost to the bottom, where an opening permits the ammunition to be supplied from the magazine. This ammunition-tube is not vertical nor in the axis of the cone, but placed on one side, and is parallel to the element of the cone which is nearest its geometrical axis. The hoist is operated by a small motor attached to the outside of the cone, close up under the protective deck.

In case of injury to the electrical apparatus, both turret and ammunition hoist may be operated by hand.

The mount proper consists of a steel envelope and frame-work completely enclosing the breech of the gun. On the forward part of the envelope, or upper carriage, are the trunnions resting in brackets secured to the platform. On the lower part are the brake cylinder and air-recuperator for returning the gun to position after recoil. The brake is of the Canet central piston type, and is so fixed to the mounting frame as to check the tendency of the piece to rotate about its axis during recoil. The elevating gear is on the right side of the mounting, and consists of a vertical worm-shaft and gear. The head of the shaft ends in a hand-wheel conveniently placed for the operator at the sighting hood. On the right side of the mount is a small, square platform on which the operator stands for sighting the gun, and is of the proper height to bring his head in the sighting hood. The levers, etc., for working the turret and gun are conveniently arranged about the platform. The turret is entered through an opening opposite the breech of the gun. This is closed by a segmental, sliding, armored door, or shield, fitting closely to the exterior curve of the turret.

The advantages claimed for this system of turret and gun-mounting are as follows: (1) Effectual protection of gun and carriage. (2) Great simplicity in all parts. (3) Very regular action of brakes. (4) Facility of loading and working. (5) Equilibrium of turret, which facilitates greatly the operations of elevating and training.

SMALL ARMS AND EQUIPMENTS.

KRNKA-HEBLER BULLET: REMARKS ON VELOCITY.—It has apparently been accepted by many people that the high velocity of the Krnka-Hebler bullet is due to reduction of pressure ahead of it by escape of gas through the axial hole. Indeed, we are told that this is a claim of the inventors, though we have not seen such a claim made. It does not, in any case, appear well-founded. The maximum velocity of the projectile is, of course, attained before the projectile actually leaves the muzzle of the piece. Now, up to the moment of leaving the muzzle the axial hole in the bullet is closed by the shoe, which acts partly as a driving wad and gas-check as well as a rotating device. It can, therefore, play no part in the high velocity attained. The hole no doubt does assist to sustain the velocity. But we are inclined to believe that its effect is overestimated and that a portion of the improvement in results has a different explanation than that given.

LEE-METFORD RIFLES: COST.—According to a statement made in Parliament by the financial secretary, the average cost of manufacture of the British service military arm, the Lee-Metford rifle, has been, at Enfield, £3 12s. 6½d.; at Sparkbrook, £3 13s. 7¾d. The Enfield factory is much the larger, and more pieces are manufactured there, and this may, perhaps, account for the slightly less cost at the Enfield Works.

KIMBALL MAGAZINE PISTOL.—Lieutenant W. W. Kimball, U.S.N., has recently patented a magazine pistol of the bolt type. The magazine is vertically arranged underneath the barrel forward of the trigger-guard and mechanism chamber. It contains five cartridges. There are two triggers. The forward one fires, retracts the bolt, and extracts the empty shell, ejecting it through the opening in the top of the barrel. A pull on the rear trigger carries the bolt forward, pushing the fresh cartridge home, and returns the forward trigger to the firing position. It would be impossible to clearly describe the mechanism without the aid of diagrams.

DOWE TEXTILE CUIRASS: RECENT EXPERIMENTS.—Herr Dowe is again to the front with his bullet-proof coat. Whatever the objections to it are, doubt of its resisting powers can hardly be further urged, for we have the testimony of too many people as to its performance. A series of experiments were made at Berlin before a specially-invited audience. Dowe himself appeared wearing one of his coats. After a bullet from a German army rifle had been shown to pass through an oaken block a yard thick, Dowe allowed himself to be shot at. Two shots were fired, each aimed at the region of the heart, but both bullets remained in the cuirass. Dowe stated after each shot that he "felt nothing," but this was probably a slight exaggeration. A horse, protected by the material, was next shot at while enjoying a feed of corn. Shot after shot was fired at the animal in rapid succession from a magazine rifle, but the horse calmly continued its meal, only disturbed once or twice by the report of the piece. Dowe had been refused permission by the police to make a public exhibition of his confidence in the impenetrability of his cuirass, but evaded the prohibition by means of a private *séance*. It is reported that the experiment will shortly be repeated in the presence of several high military authorities. There are still a few skeptics as to the efficacy of Dowe's invention. One of them, whose knowledge of ballistics is just enough to confuse his judgment, has conclusively proved to his own satisfaction that the force of the blow delivered by the bullet when brought to rest is equal to a force sufficient to raise the man three feet in the air. If this were so it would naturally follow that the man behind the gun ought, if holding the gun rigidly, to receive the same blow, in fact a somewhat greater one, as the bullet does not give out all the energy destroyed in giving it its velocity.

ALUMINUM EQUIPMENTS.—The Ordnance Department of the United States army has received a number of reports from officers throughout the country on the value of aluminum accoutrements. Experiments with this metal have been going on for some time past, and the reports received endorse its use. The articles furnished the officers for test were horseshoes, cups, belt-plates, and other articles, the aluminum for which was furnished by the Pittsburg Reduction Company. In only one instance is there an unfavorable report upon the article, and that is upon the use of horseshoes. The officer reporting upon aluminum horseshoes says they do not come up to requirements, and unless improvements are made he would not recommend their adoption. The reports upon the other articles, however, are so favorable that it is probable that the metal will be adopted for their manufacture. The Ordnance Department has also made arrangements with the Pittsburg Reduction Company to furnish it with canteens, meat-cans, etc., for test. These will be given a thorough trial, and, should they prove satisfactory, will also be adopted.—*Army and Navy Journal.*

NEW BELT, UNITED STATES ARMY.—The Ordnance Department of the army has received a sample of a new belt which will be issued to the army soldiers in conjunction with the new rifles. The belt is of blue canvass so as to match the uniform and is double-webbed, and will carry 100 cartridges, 50 more than the old belt. It has no buckle, being clasped by a simple contrivance, which has all the excellent qualities of a buckle, but is less weighty. The belts are being turned out rapidly and a sufficient number will be on hand to issue them with the new rifles.

PROJECTILES.

JOHNSON CAST-STEEL PROJECTILES: TESTS.—The report of the tests of Johnson cast-steel shot, which occurred at Indian Head Proving Grounds in March, have been received at the Navy Department. A 10-inch gun was used. The first shot was fired against a 10½-inch Harveyized nickel-steel plate with a striking velocity of 1500 f. s., and a striking energy of 7808 foot-tons. The shot broke up into a large number of pieces, leaving the point welded into the

plate. The estimated penetration was 6.5 inches. This shot wrecked the plate (which was one already used in former trials), throwing the piece in which the shot was welded (weighing about one and one-half tons) over the top, and 20 feet to the rear of the target.

On March 21, eleven days later, a second 10-inch shot was fired against a 12-inch Harveyized nickel-steel plate. This shot was soft to the file all over its surface. It struck the plate with a velocity of 1600 f. s., and an energy of 8884 f. t., the point of impact being 26 inches from the left edge, and 19 inches from the top. It smashed on the plate. The point and ogival penetrated to a depth of 6.5 inches and remained embedded. The splash was about 15 inches in diameter. The remainder of the projectile flew into small fragments. Two fine cracks, extending from the point of impact to the top, and to the left edge of the plate, were developed. Immediately after this round a forged steel armor-piercing projectile was fired against the same plate in the lower right hand corner with the same striking velocity and energy. This shell smashed on the face of the plate, the ogival welding itself into the plate, and penetrating about the same distance as the Johnson shot. The force of the blow shook out the head of the Johnson shot and enabled its penetration to be measured. The work done on the plate by the two projectiles was almost exactly the same.

On March 23, three 10-inch shot, of the same lot as those tested on March 10 and 21, underwent trial. They were not exactly alike as to treatment, etc., and all, no doubt, represented something different to the manufacturers. Each of them was soft enough to take a file all over the surface. They were designated as B-3, B-5, and B-6, and were all of standard size and weight.

Shot B-6 was fired against the *Monadnock's* 11.5-inch, curved, nickel-steel, barbette plate, weighing about 11 tons, and which had already been attacked by one 8-inch forged steel armor-piercing projectile in its ballistic test, but was still sound and uncracked. The striking velocity was 1500 f. s., energy, 7808 f. t.; impact normal, 24 inches from top and 40.5 inches from right edge; penetrated plate, 36 inches of oak backing, 12-inch oak strut, about 10 feet of earth, and ranged 200 feet beyond. The shot was found to be entire, uncracked, and symmetrical; bourrelet increased in diameter 0.06-inch, and the diameter of the projectile was 0.01-inch, too great to admit of being again used in the gun. The plate was cracked through from top to bottom, separating and exposing the backing; was much broken about shot-hole; back bulge broken off to depth of 4 inches and diameter of 30 inches; shot-hole and fragments very hot.

The next two shots were tried against the 12-inch, experimental, Harveyized nickel-steel plate used in the test of March 21.

Shot B-5, striking velocity 1600 f. s., energy 8884 f. t., struck the plate normally, 30 inches from the bottom and 24 inches from the left edge, and broke up into a large number of pieces, the heaviest weighing 19.5 pounds. The point was welded into the plate; estimated penetration 4.5 inches. All old cracks in the plate were widened, some exposing the backing; and a new one formed extending from left edge of plate to point of impact, and thence to the bottom; backing and supporting structure considerably injured and displaced.

The target was resecured as rigidly as possible. Shot B-3 was then fired. Over the point of this shot was placed a soft steel cap—externally cylindrical in shape (axes of cylinder and shot in line), 5 inches in diameter, and 3.5 inches in length—accurately fitted to the point of the projectile, and secured by three short screws 120° apart, fitting into shallow pockets in the ogival about 3 inches from the point. Total length of shot increased about 0.5-inch and weight 510 pounds. The striking velocity was 1610 f. s., energy about 9100 feet; impact 30 inches from right edge of plate, and 10 inches to the left of a soft un-Harveyized strip of metal extending across the plate in a vertical direction; and 22 inches below impact of Carpenter armor-piercing projectile. The target was completely wrecked,—plate divided into eight or nine pieces; shot penetrated to within 3 inches of back of plate,

punching off back bulge, and then breaking up into many fragments.

It would seem that, in penetrating the hard surface, the shot remained whole. The point was recovered and found to be undeformed but deeply scored, and was broken off in a plane through the screw pockets. The pieces of the ogival preserved their shape very well. The plate and the fragments around the shot-hole were very hot, but no piece of the shot was too hot to pick up with the naked hand.

The last round apparently shows the value of the soft steel cap. It supported the point of the ogival in passing through the hard surface of the plate, so that on reaching the softer metal the penetration resembled that in an untreated plate. The action of the cap resembles very much that of a soft plate placed in front of and close to the hardened surface of an armor plate. The fragments of shots B-3 and B-5 showed a fine grain approaching in some respects that of tool steel. The tests above described must be regarded as excellent for *cast*-steel projectiles. The results differ but little from those which are obtained from forged steel projectiles.—Chiefly derived from an article on "Tests of Cast-Steel Armor-Piercing Shot," by Ensign R. D. Tisdale, U.S.N., in *Proceedings of U. S. Naval Institute.*

FIRTH ARMOR-PIERCING PROJECTILE: TEST.—A test of a Firth armor-piercing 9.2-inch, forged steel projectile was recently made at Shoeburyness. It was one of a lot of 160 presented for acceptance, and two were selected at random for proof. The projectiles were all of 9.2-inch calibre and weighed 380 pounds each. The first was fired with a striking velocity of 1985 feet per second against a 14-inch compound plate. The result was regarded as highly satisfactory. The shot passed through the centre of the plate, then through 4 feet of oak backing, and buried itself in a heap of sand in the rear. Upon recovery and examination no cracks were found, and the projectile was very little deformed; there was a slight bulge near the front band, and the total upsetting amounted to 0.6-inch in a length of 29 inches. In view of the satisfactory character of the result, the lot were accepted without firing a second shot.

L. S. VAN DUZER,
Lieutenant U.S.N.
PHILIP ANDREWS,
Ensign U.S.N.

SERVICE SALAD.

BALLADS OF BATTLES.

(From the New York Sun.)

Bannockburn.

ROBERT BRUCE'S ADDRESS TO HIS ARMY.

Scots, wha hae wi' Wallace bled,
Scots, wham Bruce has often led,
Welcome to your gory bed,
Or to victorie!

Now's the day, and now's the hour:
See the front o' battle lower;
See approach proud Edward's power—
Chains and slaverie!

Wha will be a traitor knave?
Wha can fill a coward's grave?
Wha sae base as be a slave?
Let him turn and flee!

Wha for Scotland's king and law
Freedom's sword will strongly draw,
Freeman stand or freeman fa',
Let him follow me!

By oppression's woes and pains!
By our sons in servile chains!
We will drain our dearest veins,
But they shall be free!

Lay the proud usurpers low!
Tyrants fall in every foe!
Liberty's in every blow!
Let us do, or die!

ROBERT BURNS.

The Bonnets of Bonnie Dundee.

To the lords of convention 'twas Claverhouse who spoke,
"Ere the King's crown shall fall, there are crowns to be broke;
So let each cavalier who loves honor and me
Come follow the bonnets of bonnie Dundee!"

Come fill up my cup, come fill up my can;
Come saddle your horses, and call up your men;
Come open the west port and let us gang free,
And it's room for the bonnets of bonnie Dundee!

Dundee he is mounted, he rides up the street,
The bells are rung backward, the drums they are beat;
But the provost, douce man, said, "Just e'en let him be,
The gude toun is well quit of that deil of Dundee!"

As he rode doun the sanctified bends of the Bow,
Ilk carline was flyting and shaking her pow;
But the young plants of grace they looked cowthie and slee,
Thinking, luck to thy bonnet, thou bonnie Dundee!

With sour-featured whigs the grass market was thranged,
As if half the west had set tryst to be hanged:
There was spite in each look, there was fear in each ee,
As they watched for the bonnets of bonnie Dundee.

These cowls of Kilmarnock had spits and had spears,
And lang-hafted gullies to kill cavaliers;
But they shrunk to close-heads, and the causeway was free
At the toss of the bonnet of bonnie Dundee.

He spurred to the foot of the proud castle rock,
And with the gay Gordon he gallantly spoke:
"Let Mons Meg and her marrows speak twa words or three,
For the love of the bonnet of bonnie Dundee."

The Gordon demands of him which way he goes.
"Where'er shall direct me the shade of Montrose!
Your Grace in short space shall hear tidings of me,
Or that low lies the bonnet of bonnie Dundee.

"There are hills beyond Pentland and lands beyond Forth;
If there's lords in the Lowlands, there's chiefs in the north;
There are wild Duniewassals three thousand times three
Will cry 'Hoigh!' for the bonnet of bonnie Dundee.

"There's brass on the target of barkened bull hide,
There's steel in the scabbard that dangles beside;
The brass shall be burnished, the steel shall flash free,
At a toss of the bonnet of bonnie Dundee.

"Away to the hills, to the caves, to the rocks,
Ere I own a usurper I'll couch with the fox;
And tremble, false whigs, in the midst of your glee,
You have not seen the last of my bonnet and me."

He waved his proud hand, and the trumpets were blown,
The kettledrums clashed, and the horsemen rode on,
Till on Ravelston's cliffs and on Clermiston's lea
Died away the wild war notes of bonnie Dundee.

Come, fill up my cup; come fill up my can;
Come, saddle the horses and call up the men;
Come, open your doors and let me gae free,
For it's up with the bonnets of bonnie Dundee!

SIR WALTER SCOTT.

Battle of the Baltic.

OF Nelson and the north
Sing the glorious day's renown,
When to battle fierce came forth
All the might of Denmark's crown,
And her arms along the deep proudly shone;
By each gun the lighted brand
In a bold determined hand,
And the prince of all the land
Led them on.

Like leviathans afloat
Lay their bulwarks on the brine;
While the sign of battle flew
On the lofty British line—
It was ten of April morn by the chime.
As they drifted on their path
There was silence deep as death;
And the boldest held his breath,
For a time.

But the might of England flushed
To anticipate the scene;
And her van the fleeter rushed
O'er the deadly space between.
"Hearts of oak!" our captain cried: when each gun
From its adamantine lips
Spread a death-shade round the ships,
Like the hurricane eclipse
Of the sun.

Again! again! again!
And the havoc did not slack,
Till a feebler cheer the Dane
To our cheering sent us back;
Their shots along the deep slowly boom—
Then ceased—and all is wail,
As they strike the shattered sail,
Or in conflagration pale,
Light the gloom.

Out spoke the victor then
As he hailed them o'er the wave:
"Ye are brothers! ye are men!
And we conquer but to save;

So peace instead of death let us bring;
But yield, proud foe, thy fleet,
With the crews, at England's feet,
And make submission meet
To our king."

Then Denmark blessed our chief,
That he gave her wounds repose;
And the sounds of joy and grief
From her people wildly rose,
As death withdrew his shades from the day.
While the sun looked smiling bright
O'er a wide and woeful sight,
Where the fires of funeral light
Died away.

Now joy, old England, raise!
For the tidings of thy might,
By the festal cities' blaze,
Whilst the wine cup shines in light;
And yet, amidst that joy and uproar,
Let us think of them that sleep
Full many a fathom deep,
By thy wild and stormy steep,
Elsinore!

Brave hearts! to Britain's pride
Once so faithful and so true,
On the deck of fame that died,
With the gallant good Riou—
Soft sigh the winds of heaven o'er their grave!
While the billow mournful rolls,
And the mermaid's song condoles,
Singing glory to the souls
Of the brave!

THOMAS CAMPBELL.

A New Method of Mooring and Unmooring Ship.

ALL officers of the navy whose duty brings them in contact with the working of the ground-tackle of the ship have had occasion to feel doubtful at times about unshackling chains in mooring and unmooring.

The present method of mooring and unmooring is cumbersome and dangerous, and ought to be done away with.

In its place I would suggest the following as a substitute:

In the inboard end, next to the end link of each shot of both bower cables—up to sixty fathoms, the limit to which a ship moors—have a swivel, made as the ordinary swivel is now made, to keep the turns out of the chain. Have the lower or outboard end of the swivel large enough to take an extra shackle-pin, but do not add to its length, as by so doing it would not work well over the capstan whelps.

In mooring, put the clear hawse pendant on the lee chain, pay out, haul over, and shackle to swivel of riding-chain, using an extra shackle, then unshackle the inboard end of the lee chain.

By the method here advocated the large and clumsy mooring-swivel, with the attendant danger of putting it on and taking it off, is done away with.

In its place we have a smaller mooring-swivel always ready.

I claim that the chain-swivel is as strong as the mooring-swivel now in use.

During my twenty years' experience I have never known one of the chain-swivels to carry away,—and no ship drops an anchor without riding to one. Neither have I been able to find an officer who has, while the mooring-swivel in present use has often come to grief.

W. L. HILL,
Boatswain U.S.N.

IN a recent article on Coffee and Cocoa, the eminent German chemist, Professor Stutzer, speaking of the Dutch process of preparing Cocoa by the addition of potash, and of the process common in Germany, in which ammonia is added, says, "The only result of these processes is to make the liquid appear turbid to the eye of the consumer, without effecting a real solution of the Cocoa substances. This artificial manipulation for the purpose of so-called solubility is, therefore, more or less inspired by deception, and always takes place at the cost of purity, pleasant taste, useful action, and aromatic flavor. The treatment of Cocoa by such chemical means is entirely objectionable. . . . Cocoa treated with potash or ammonia would be entirely unsalable but for the supplementary addition of artificial flavors, by which a poor substitute for the aroma driven out into the air is offered to the consumer." The delicious Breakfast Cocoa made by WALTER

BAKER & Co., of Dorchester, Mass., is absolutely pure and soluble. No chemicals, or dyes, or artificial flavors are used in it.

Cottolene as a Trade-Mark.

(*From the Oil, Paint, and Drug Reporter.*)

AN important and interesting trade-mark suit, which has been before the courts for some time, has recently reached a decision in the United States Circuit Court for the Southern District of New York, Judge Townsend presiding. As the decision has a wide application, and contains numerous interesting references, with a full presentation of the law as applied to trade-marks, we give the decision in full, believing it will prove of interest to our readers.

This is a bill in equity for an injunction against the infringement of complainant's trade-mark "Cottolene" by the use of the word "Cottoleo."

The complainant began the manufacture of the article and devised and registered the word "Cottolene" as a trade-mark in 1887. It obtained a large and increasing business. In May, 1892, its sales amounted to a million pounds a month.

"Cottolene" is a substitute for lard. It is composed of cotton-seed oil and the product of beef fat. Beef fat or suet, under heat and pressure, yields two products, oleo-stearine and oleo-margarine. The former is a solid, and is used in making a substitute for lard. The latter is more nearly a liquid, and is used in making a substitute for butter.

The word "oleo" is used colloquially among merchants to indicate either oleo-margarine or oleo-stearine.

At the time when defendant, in 1892, commenced the manufacture of "Cottoleo," which is identical in composition, character, and appearance with "Cottolene," other articles made of the same ingredients were on sale in the market under the various names other than "Cottolene," such as "Lardine," "Cotton Oil Lard," "Panteleia," "Golden Beef Drippings," "Beef Frying Fat," etc.

These facts were known to the defendant.

The compound in question was well known, and defendant had a right to manufacture and sell it.

Defendant sold under its own trade-name, and except in the use of the word "Cottoleo" stenciled on tierces and tubs, did not simulate the labels or packages used by complainant.

This article, however, is frequently sold in tierces to bakers, and in tubs to grocers, who sold it to customers from such tubs by the pound, so that the customer does not necessarily see the package at all.

It seems clear that "Cottolene" is a proper and valid trade-mark. Although it may suggest cotton oil, it is not sufficiently descriptive to render it invalid as a trade-mark under the recent decisions.

The rule that names suggestive of the nature or composition of articles may be valid trade-marks if not too accurately descriptive of their character or quality has been applied to Burnett *vs.* Phalon, 9 Bos. 192, to the use of the word "Cocaine;" in Glen Cove Mfg. Co., 22 F. R. 823, to "Maizena;" in Leonard *vs.* White, 38 F. R. 922, to "Valvoline;" in Battle & Co. *vs.* Finlay, 45 F. R. 796, to "Bromidia."

A more recent case is Keasbey *vs.* Brooklyn Chemical Works, decided by the Court of Appeals in New York since the argument of this case. The trade-mark in question in that case is Bromo Caffeine.

This was held to be a valid trade-mark in the Supreme Court, which decision was overruled by the General Term and cited by the defendant in support of its contention that "Cottoleo" was a descriptive word.

This article called Bromo Caffeine, made by the plaintiff in that case, was found to contain caffeine, bromide of potassium, and other substances.

The opinion in the Appellate Court says that bromide "might refer to bromide of potassium or bromide of sodium, or to any other bromide, or to bromine," and thus stated its conclusion: "We think this case comes within the doctrine of those cases which have protected the words of the trade-mark, although they suggested more or less the

composition, quality, or characteristics of the article.

It also seems clear that the word "Cottoleo" is sufficiently similar to "Cottolene" to infringe it. When the printed form as well as the sound is considered, the resemblance is as great as that of Cellonite to Celluloid, Celluloid Mfg. Co. *vs.* Cellonite Mfg. Co., 32 F. R. 94; Wamyesta to Wamsutta, Wamsutta Mills *vs.* Allen Cox's Manual, 660: Maizharina to Maizena, Glen Cove Mfg. Co. *vs.* Ludeling, 22 F. R. 823; Saponiti to Sapolio, Enoch Morgan Sons Co. *vs.* Edler, Cox's Manual, 713. See also Estes *vs.* Leslie, 29 F. R. 91, in which "Chatterbook" was held to infringe "Chatterbox."

Defendant's counsel does not seem to seriously controvert these propositions. His defense is novel and ingenious. He says that complainant can have no better case here than he would have if his trade-mark had been "Cottoleo" and the defendant had used the same word, and he maintains that "Cottoleo" is so far a descriptive words that it cannot be used as a trade-mark.

He says, "If such an alleged trade-mark would not have prevented the defendant from using the same word, certainly a trade-mark claimed in any other word cannot prevent the defendant from using it."

He says that, as this was a new compound when complainants began to manufacture it, they could not, by their choice of a name adopted as a trade-mark, restrict any parties thereafter manufacturing in their choice of descriptive words.

He says that defendant was justified "in using a word which was euphonious, and which indicated the ingredients of which the product was composed, and that no trade-mark claimed or owned by the complainant can abridge that right."

The questions as stated by defendant then are: *First.* Is "Cottoleo" so far a descriptive word that it could not be used as a trade-mark?

Second. Where a manufacturer originating a new compound has given it a name suggestive of some of the ingredients, but a valid trade-mark, may a later manufacturer adopt a name similar in appearance and sound, provided the same is so far descriptive of the article that it would not be valid as a trade-mark?

Defendant's counsel, in support of his contention that "Cottoleo" is a descriptive word, quotes the following among others as having been held descriptive, and therefore invalid as trade-marks.

Cherry Pectorial, Ayer *vs.* Rushton, 7 Daly, 9; Taffe Tolu, Colgan *vs.* Danheis, 35 F. R. 150; Rye and Rock, Van Beil, *vs.* Prescott, 46 N. Y. Super. Ct. 542; Straight Cut, Ginter *vs.* Kinney Tob. Co., 12 F. R. 782; Mascassar, Rowland *vs.* Breidenboch, 1 Coxe on Trade-marks, No. 386; Cresylic Ointment, Carbolic Soap Co. *vs.* Thompson, 25 F. R. 625; Iron Bitters, Brown Chemical Co. *vs.* Meyer, 139 U. S. 540; figures ½ on cigarettes composed of two kinds of tobacco; Kinney *vs.* Allen, 1 Hughes, 106.

But in these cases and the others cited by defendant the words claimed as trade-marks were either originally descriptive or had become incorporated into the English language so as to be recognized as descriptive of the article, and therefore incapable of exclusive appropriation.

The evidence shows that the word "Cottoleo" is not formed in accordance with any established rules for the formation of a new word. Cott is merely suggestive of cotton oil. It does not describe it, and oleo may describe or refer to oleo-margarine as well as to oleo-stearine, or to other oils. Oleo is ordinarily used as a suffix and not a prefix, and it is shown to be the rule in coining compound words that the name of the more important article is placed last.

There were various other words in common use describing the product when the defendant coined the word. It does not, therefore, come within the principle of those cases where there is only a single name to designate the new article, or where the new name is used merely as descriptive of the article.

Defendant's theory that where a suggestive trade-mark has been adopted, another desiring to obtain the benefit of the trade-mark may coin a word not already in the language, and not made according to the regular rules for coining new words, yet sufficiently indicative of the quality and character of the article to be invalid as a trade-mark, and sufficiently like the trade-mark in use to obtain benefit of an infringe-

ment, seems to open the door for ingenious fraud.

Under the circumstances of this case, the conduct of the defendant in rejecting all existing names, and in coining a new name which conveys to the eye and ear so close an imitation of complainant's trade-mark, seems to indicate a design to impose his article upon the public as that of the complainant, or at least to obtain the substantial benefit of complainant's trade-mark.

It is well settled that the inventor of an arbitrary or fanciful name may apply it to an article manufactured by him to distinguish his manufacture from that of others, and that the subsequent use of such word by the public to denote the article does not deprive the originator of such word of his exclusive right to its use. Selschow *vs.* Baker, 93 N. Y. 59; Ausable Horse Nail Co. *vs.* Essex Horse Nail Co., 32 F. R. 74; Celluloid Mfg. Co. *vs.* Read, 47 F. R. 712.

Neither does the fact that the defendant sold under its own name, and made no attempt other than by the use of the word "Cottoleo" to palm off his goods as those of the complainant, constitute a defense. Roberts *vs.* Sheldon, 18 O. G. 1277, and cases there quoted. Sawyer *vs.* Horn, 1 F. R. 24; Hier *vs.* Abrahams, 82 N. Y. 319; Battle *vs.* Finlay, 45 F. R. 796.

It seems to be the law that when manufacturers have educated the public to ask for a certain article by its trade-mark name, they have acquired the right to insist that products manufactured by others shall not be given to the public under that name. It is just that it should be so, for the benefit derived from such service in furnishing articles of recognized value. Moreover, if the trade-mark name can only be obtained by faithful name might be adopted by others, inferior articles might then be produced and sold under it; and thereby the value to manufacturers of the reputation of the name used by them as a trade-mark would be destroyed.

There will be the usual decree for an injunction and an accounting.

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MILITARY ORDER OF THE LOYAL LEGION OF THE UNITED STATES.

Companions of the Loyal Legion are invited to contribute to this department. News of the Commanderies is always welcome, but suggestions likely to inure to the benefit of the whole organization are of higher value, and therefore particularly desired. The pages of the Loyal Legion Department of the "United Service" are always at the service of members of the Order desiring to discuss matters of general interest to their comrades of the Military Order of the Loyal Legion.

New York Commandery.

Stated meeting held December 5, 1894.

To THE FIRST CLASS.—Captain **William J. Buckley**, U.S.V.; Major **Henry S. Clement**, U.S.V.; First Lieutenant **James Henry Cochnower**, U.S.V.; Major **Samuel Comfort**, U.S.V.; First Lieutenant **Spencer C. Doty**, U.S.V.; Brevet Major **Mahlon B. Folwell**, U.S.V.; Brevet Brigadier-General **Edward B. Fowler**, U.S.V.; First Lieutenant **Frank P. Frost**, U.S.V.; First Lieutenant **Moses M. Frye**, U.S.V.; Captain **Truman K. Fuller**, U.S.V.; Surgeon **Arthur Mathewson**, late U.S.N.; Captain **Thomas Merriam**, U.S.V.; First Lieutenant **John J. Perine**, U.S.V.; Captain **Anthony B. Porter**, U.S.V.; Second Lieutenant **Nathan B. Roberts**, U.S.V.; First Lieutenant **A. Beaufort Villeplait**, U.S.V.; First Lieutenant **Wm. H. Warner**, U.S.V.; Colonel **William B. Wooster**, U.S.V.

To THE FIRST CLASS (by inheritance).—**Robert C. McCormick, Edward Graham Taylor.**

To THE SECOND CLASS.—**Frederick Townsend, Jr., George Curtis Treadwell.**

Maine Commandery.

Stated meeting held December 7, 1894.

To THE FIRST CLASS.—Lieutenant **George Almon Russell**, U.S.V.; Lieutenant **Horace Hopkins Shaw**, U.S.V.; Brevet Captain **Charles Wesley Keyes**, U.S.V.

Illinois Commandery.

Stated meeting held December 13, 1894.

To THE FIRST CLASS.—Lieutenant **Francis Julius Fitswilliam**, U.S.V.; Captain **Henry Fox, Jr.**, U.S.V.; Lieutenant **Robert Mann Woods**, U.S.V.

District of Columbia Commandery.

Stated meeting held December 4, 1894.

To THE FIRST CLASS.—Surgeon **Edward Ridgely Baer**, U.S.V.; Brevet Major-General **Henry Capehart**, U.S.V.; Second Lieutenant **William Wallace Case**, U.S.V.; Lieutenant Colonel **Alexander Cummings McWhorter Pennington**, U.S.A.; Captain **Alfred Rufus Quaiffe**, U.S.V.

To THE FIRST CLASS (by inheritance).—**Arthur Edward Henry Middleton.**

To THE SECOND CLASS.—Second Lieutenant **John Henry Russell, Jr.**, U.S.M.C.; Assistant Surgeon **Henry Delano Wilson**, U.S.N.

Michigan Commandery.

Stated meeting held December 6, 1894.

To THE FIRST CLASS.—Second Assistant Engineer **Hillary Messimer**, U.S.N.; Brevet Captain **Theodore A. McGraw**, U.S.V.

Missouri Commandery.

Stated meeting held November 3, 1894.

To THE FIRST CLASS.—Colonel **Chas. G. Stifel**, Major **Thomas L. Carnahan**,

Colorado Commandery.

Stated meeting held December 4, 1894.

To THE FIRST CLASS.—Major George T. Robinson, U.S.A.; Lieutenant Thomas Ward, U.S.V.

To THE FIRST CLASS (by inheritance).—Charles Albert Wilkins.

To THE SECOND CLASS.—George L. Hodges, Edward S. Smith.

TRANSFERS.

District of Columbia Commandery.

Brevet Brigadier-General Frederic D. Sewell to Maine Commandery.

Illinois Commandery.

Captain Frederic Otto von Fritsch to New York Commandery.

Michigan Commandery.

Captain Dolphus Torry to Missouri Commandery.

Missouri Commandery.

Major A. S. B. Keyes, U.S.A., to Pennsylvania Commandery.

NECROLOGY.

Maine Commandery.

Acting Master Edmund Buxton Mallet, Sr., U.S.N., November 9, 1894, at West Bath, Maine.

Illinois Commandery.

Chaplain Benjamin Brown Hamilton, November 11, 1894, at Upper Alton, Ill.; Captain Abraham Frank Risser, November 26, 1894, at Chicago, Ill.

Missouri Commandery.

Companion Luin R. Thacher, October 31, 1894, at Kansas City, Mo.

THE following is promulgated for the information of the Order:

CHANGES IN MEMBERSHIP, QUARTER ENDING OCTOBER 31, 1894.

COMMANDERY OF	GAIN.			LOSS.			NET GAIN.			NET LOSS.			MEMBERSHIP, October 31, 1894.			
	First Class.	Second Class.	Third Class.	First Class.	Second Class.	Third Class.	First Class.	Second Class.	Third Class.	First Class.	Second Class.	Third Class.	First Class.	Second Class.	Third Class.	Total.
Pennsylvania	22	4		12	2	1	10	2				1	1042	115	4	1161
New York	16			5			11						1080	68	4	1152
Maine	4						4						147	7		154
Massachusetts	4			2	1	1	2				1	1	811	53	13	877
California	7	1		12				1		5			566	49	10	625
Wisconsin				2						2			206	6	2	214
Illinois	4	1		8	3					4	2		494	59	5	558
District of Columbia	9			2	1		7				1		625	36	1	662
Ohio	8	3		6			2	3					846	62	4	912
Michigan				2		1				2		1	260	12	2	274
Minnesota	2			3						1			285	24	3	312
Oregon				2						2			71	9		80
Missouri	2			1	1		1				1		280	19	5	304
Nebraska				1						1			138	17	3	158
Kansas	2	2		4		1		2		2		1	236	25	3	264
Iowa	1	1				1	1	1				1	155	10	3	168
Colorado	7			1	1		6				1		190	18		208
Indiana	7				1		7				1		217	14	1	232
Washington	1				1		1				1		49	11		60
Vermont	1	1					1	1					90	13		103
Totals	97	13		63	11	5	53	10		19	8	5	7788	627	63	8478